ISRO
Technician-B
Electrician
Solved Paper

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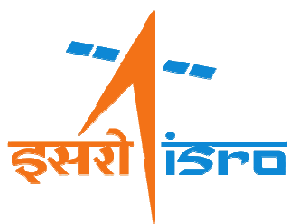 ▶ **yct books official**

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CONTENT

Indian Space Research Organisation (ISRO)

Syllabus

The Indian Space Research Organisation (ISRO) conducts the recruitment drive for the post of Technician in two stages, a written and a skill test. The final selection would be done on the basis of the marks obtained in the written test provided that the candidate qualified in the skill test. It is important to know the syllabus and exam pattern for the exam so that you can start your preparation accordingly. A detailed ISRO Technician syllabus is discussed in the article below.

ISRO Technician-(B) Syllabus

Start your preparation by knowing about the ISRO Technician Syllabus. The official syllabus for the examination for the 2024 cycle is yet to be released. However, references can be taken from the previous syllabus of the examination. Detailed post-wise syllabus for ISRO Technician is given below. The Syllabus for the year 2024 is likely to be the same. Any changes to the syllabus will be updated in the formal notification.

MCQ will be asked in this stage of the examination. Candidates will have to face questions from Basic English, Arithmetic, General Knowledge, and respective technical subjects. The detailed syllabus for Stage 1 of the examination is given below:

❐ **Basic English**
- Verb
- Tenses
- Adverb
- Articles
- Grammar
- Synonyms
- Antonyms
- Vocabulary
- Conclusion
- Comprehension
- Word Formation
- Error Correction
- Theme detection
- Fill in the Blanks
- Unseen Passages
- Idioms & Phrases
- Passage Completion
- Sentence Completion
- Subject-Verb Agreement
- Sentence Rearrangement

❏ Arithmetic

- Trigonometry
- Partial Fractions
- Complex Numbers
- Analytical Geometry
- Differential Equations
- Integration and Its Applications.
- Differentiation and its Applications

❏ General Knowledge

- Current National and International events of importance.
- Sports and Entertainment.
- Indian History (ancient, medieval, modern).
- Indian Geography, Economy, and Agriculture.
- Natural Resources, Planning, Sustainable and Inclusive Development.
- Natural Calamities and Disaster Management.
- Human Resource Development Index of India.
- Basic Knowledge of the Indian Constitution.
- Indian National Movement.
- Human Rights.
- Various aspects of Rural and Urban Development.
- General Science.
- Development and Environmental Problems.
- Biotechnology and Health Issues.
- Development of Science and Technology In India

ISRO Technician-(B) Electrician

The syllabus for the technical subject is different for each category. The main category of technical subjects are electronics, mechanical, electrical engineering, and computer science. Detailed syllabus of each technical subject is given below:

- Basic Electrical
- The basic concept of the use of electricity and its hazards.
- Tools for an Electrician
- Estimating and Costing
- Network Analysis.
- Utilization of Electrical Energy
- Electrical and Electronic Materials
- Electrical Machines
- Power Electronics & Drives
- Electronics Devices.
- Electromagnetic Theory.
- Analog and Digital Electronics.
- Electrical and Electronic Measurements.
- Power System Analysis & Control
- Power System Protection.
- Control Systems.
- Power System
- Power generation
- Switchgear and Protection

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Exam Date: 18.04.2024]   **[Time -1:00 PM - 2:30 PM**

1. How do we remove ripples?
    (a) with resistor   (b) with inductor
    (c) with snubber circuit (d) with filter circuit

Ans : (d) To reduce the ripples in a rectifier circuit capacitor filter are used.
For lower ripple factor:- Resistance of load should be increased,
■ Input frequency should be increased.
■ Capacitance (C) should be increased.
Note- The ripple can be reduced by smoothing capacitors in parallel to the load which convert the ripple voltage into a smoother dc voltage.

2. The curve representing Ohm's law is
    (a) Sine function   (b) Linear
    (c) Parabola   (d) Hyperbola

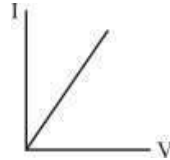**Ans : (b)** The curve representing Ohm's law is linear.
■ The curve for Ohm's law in an ohmic conductor follows a straight line.
■ Ohm's law exhibits a linear relationship between the applied voltage and the resulting electric current.
Ohm's law:- $V \propto I$
                     $V = IR$

$$\boxed{R = \frac{V}{I}}$$

Where, V = Voltage in volt
       R = Resistance in ohm.
       I = Current in amp.

3. Calculate the apparent power of a star connected 3 phase load, if it is connected across 3 phase 415 volt, 50 Hz supply at 0.8 power factor and the phase current is 10 amperes.
    (a) 12.45 kVA   (b) 7.188 kVA
    (c) 3.320 kVA   (d) 57.50 kVA

Ans : (b) Given,
      $V_L = 415V$ & $I_P = 10A$
We know that,
In star connection, $\boxed{I_P = I_L = 10 \text{ A}}$
So Apparent power $= \sqrt{3}V_L.I_L$
              $= \sqrt{3} \times 415 \times 10$
              $= 1.732 \times 415 \times 10$
              $= 7,187.8 \text{ VA}$
              $= 7.1878 \text{ kVA}$
              $= 7.188 \text{ kVA}$

4. If a person faints due to suffocation, the first aid to be given is
    (a) Give him a warm drink
    (b) Sprinkle cold water on his pace
    (c) Place him on well ventilated
    (d) Give him artificial respiration

Ans : (c) If any person faints due to suffocation. We should placed him on well ventilated location.
■ Fainting is usually the result of a lack of oxygen to the brain.

5. One or more of the following conditions are essential for parallel operation of transformers
    (a) Polarity of the transformers should be same
    (b) Equal voltage ratio should be provided
    (c) Percentage impedance should be same
    (d) All of these

Ans : (d) The condition for parallel operation of transformer:-
1. Same voltage ratio and turn ratio (both primary and secondary voltage rating is same)
2. Same percentage impedance and X/R ratio
3. Same kVA rating
4. Same polarity
5. Same phase sequence
6. Same frequency

6. The average value of alternating current for a pure sine wave is equal to
    (a) 0.536 x maximum value of current
    (b) 0.636 x maximum value of current
    (c) 0.707 x maximum value of current
    (d) 0.737 x maximum value of current

Ans : (b) The average value of sinusoidal wave form over one complete cycle is zero as two halves cancel each other, so the average value is taken over half a cycle.

$$V_{avg} = \frac{1}{\pi} \int_0^\pi V_p \sin\theta \, d\theta$$

$$V_{avg} = \frac{V_p}{\pi}(-\cos\theta)_0^\pi$$

$$\boxed{V_{avg} = \frac{2V_p}{\pi} = 0.63 \times V_p}$$

Therefore, the average value of a sinusoidal wave is 0.637 times the peak value.

7. **The function of current reverser in earth tester is to**
   (a) Change AC to DC supply
   (b) Bring the needle to stand still position without vibration
   (c) Change DC to AC supply
   (d) Providing controlling torque

Ans : (c) The current reverser is used to convert dc to ac so that the earth resistance test can be done with alternating current.

8. **In an energy meter, speed of the aluminium disc is adjusted using**
   (a) copper shading band (b) series magnet
   (c) shunt magnet (d) break magnet

Ans : (d) The break magnet is used for adjusting speed of an energy meter. The breaking torque opposes the movement of the disc, thus reducing its speed.
■ The speed of disc can be controlled by changing flux. If the energy meter runs fast, it can be slowed down by adjusting the position of the breaking magnet and making it move away from the disc and to increase the speed moving it closer to the center of disc.

9. **The number of valance electrons of the germanium element is?**
   (a) 5 (b) 4
   (c) 3 (d) 2

Ans : (b) The number of valance electrons of the germanium element is 4.
Germanium ($_{32}$ Ge$^{72.63}$):–
■ Germanium is the third element that belongs to the periodic table's fourteenth column.
■ Clemens A. Winkler discovered the Germanium element in the year 1886 in Germany.
■ Germanium has the electrical conductivity between an insulator and a conductor; therefore, it is also called a semiconductor.

10. **Regulation of transformer means**
   (a) Change in terminal voltage
   (b) Change of power factor
   (c) Change in secondary voltage from the no load to full load
   (d) Change of current due to load variations

Ans : (c) In transformer, voltage regulation is the change in secondary terminal voltage from no load to full load at a specific power factor of load.

Voltage regulation $= \dfrac{V_0 - V}{V_0}$

Voltage regulation for the transformer is given by the ratio of change in secondary terminal voltage from no load to full load at no load secondary voltage.
Transformer when connected to load:

% Voltage regulation $= \dfrac{V_{NL} - V_{FL}}{V_{NL}}$

Transformer under no load:

% Voltage regulation $= \dfrac{V_{NL} - V_{FL}}{V_{FL}}$

11. **Which loss is determined by conducting short circuit test in transformer?**
   (a) Stray loss (b) Eddy current loss
   (c) Hysteresis loss (d) Copper loss

Ans : (d) A short circuit test is conducted on a transformer to determine copper loss. This test is conducted on the HV side keeping the LV side short circuit. This test is performed at the rated current since, the LV is short circuited.
■ Open circuit test is conducted on the LV side keeping the HV side is open circuited.
■ A open circuit test is conducted on a transformer to determine iron loss.

12. **What is the unit of capacity of secondary cell?**
   (a) Volt ampere (b) Kilo watt
   (c) Watt hour (d) Ampere hour

Ans : (d) The unit of capacity of secondary cell is ampere-hour.
■ The capacity of cell is measured by the discharging at a constant electric current until if fully drain out for the particular time. Hence, the capacity of the cell/battery is measured by the ampere-hour rating.

13. **Which one of the following starters is used for starting D.C. series motor.**
   (a) Drum controlled starter
   (b) 3 point starter
   (c) Rotor resistance starter
   (d) 4 point starter

Ans : (a) DC series motor are often employed on cranes, elevators, tramcars and other applications, where motor is under the direct control of an operator in these applications frequency starting, variation of speed stopping and reversing may be necessary. A drum controller is employed for starting DC series motor. A drum controller is in the form of rotating drum.
■ Two - point starter is used for DC series motor.
■ Three - point starter is used for DC shunt motor or compound wound motor.
■ A four - point starter is used for DC shunt motor with field working control.

14. **The thread on conduit pipes in all cases should have a length of range.**
   (a) 10 to 20 mm (b) 11 to 27 mm
   (c) 12 to 25 mm (d) 15 to 35 mm

Ans : (b) In all cases, the thread on conduit pipe should have a length of range 11 to 27mm.

15. **The internal barrier potential of silicon diode is _____**
   (a) 0.3 volt (b) 0.5 volt
   (c) 0.6 volt (d) 0.7 volt

Ans : (d) The internal barrier potential of silicon diode is 0.7 volt.
Barrier voltage:-
■ The minimum voltage required by a diode to conduct is known as barrier voltage.

- The potential difference required to move the electrons through the electric field is called the barrier potential.
- The barrier potential of the "Germanium" diode is 0.3V.
- The barrier potential of the "Silicon" diode is 0.7V.

16. Which energy is converted into electrical energy by generator?
  (a) Heat   (b) Mechanical
  (c) Chemical   (d) Kinetic

Ans : **(b)** A generator is a device that converts mechanical energy into electrical energy.
- In motor, electrical energy converted into mechanical energy.

17. Heavy current in the D.C. circuit can be measured with the help of
  (a) Current transformer
  (b) Clip on ammeter
  (c) Parallel shunt resistance with ampere meter
 (d) Series resistance with ampere meter

Ans : **(c)** To measure heavy current we can place a shunt resister in parallel with ampere meter. Most of the current flows through the shunt, and only a small fraction flows through the meter. This allows the meter to measure larger current.

18. An ammeter is connecting in _____ in the circuit.
  (a) Series
  (b) Parallel
  (c) Either series or parallel
  (d) None of these

Ans : **(a)** An ammeter is connecting in series in circuit.
- An ammeter is a device or instrument that measures the amount of current passing through a circuit.
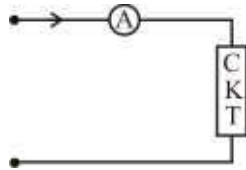
19. A stepper motor is
  (a) A D.C. motor
  (b) A single phase A.C. motor
  (c) A multiphase motor
  (d) A two phase motor

Ans : **(c)** A stepper motor is multiphase motor that converts electrical power into mechanical power. It is brushless, synchronous motor that can divide a full rotation into a expansive number of step.
- Stepper motor are generally preferred when we need an in expensive, easy to control solution and when efficiency and high torque and high speed are not necessary.

- Stepper motor offer good torque at low speed, so they are great for holding position and also tend to have a long life span.
- They can work in open loop control system.

Disadvantages of stepper motor:
- Efficiency is low.
- Accuracy is low.
- If the motor is not controlled properly then resonance can occur.

Note:
(i) Step angle in stepper motor;

$$\beta = \frac{N_s - N_r}{N_s \cdot N_r} \times 360^\circ$$

Where,
     N_s = Number of stator poles/teeth
     N_r = Number of rotor poles/teeth

(ii) Speed of stepper motor $= \dfrac{\beta f}{360^\circ}$

Where,
     f = stepping rate/frequency
     β = step angle

(iii) Another formula of step angel:

$$\beta = \frac{360^\circ}{m \times N_r} = \frac{360^\circ}{\text{No. of stator phases} \times \text{No. of rotor teeth}}$$

Where,
     β = step angle
     m = number of stator phases
     N_r = number of rotor poles or teeth

20. Scott connections are used for
  (a) 1 phase to 3 phase transformation
  (b) 3 phase to 2 phase transformation
  (c) 3 phase to 1 phase transformation
  (d) 2 phase to 3 phase transformation

Ans : **(b)** The Scott connection is the method of connecting two single phase transformers to perform 3-phase to 2-phase conversion and vice-versa.
- Scott connection of transformer is also known as T-T connection.
- The two transformers are connected electrically but not magnetically.
- In Scott connection, the percentage tapping of main transformer and teaser transformer respectively are 50% and 86.6%

21. What is the cause for hunting effect in Alternators?
  (a) due to overload
  (b) due to continuous fluctuation in load
  (c) running with fluctuation of speed
  (d) running without load

Ans : **(b)** Hunting is the phenomenon of the alternator, which occur due to continuous fluctuation in load and is stopped by damper winding.

Causes of Hunting:-
■ Sudden change in load.
■ Sudden change in supply system.
■ Load containing harmonic torque.
Method of eliminating hunting:-
1. By using the damper winding.
2. By using the flywheel.
Damper winding:-
■ Damper winding is made with low resistance copper, aluminium, or brass.
■ They are inserted in the slots made under the pole shoes.
Function of damper winding:-
1. In alternator to eliminate hunting and to suppress the negative sequence.
2. In synchronous motor to eliminate hunting and starting purpose.

22. **Rating of fuse for the protection of single phase motors should be equal to 3 times the**
    (a) running current   (b) starting current
    (c) no load current   (d) full load current

Ans : (d) The rating of fuse for the protection of single phase motor should be equal to three times of the full load current. The fuse rating can be calculated by dividing power used by the appliance by the voltage going into the appliance.

$$I = P/V$$

■ For the lighting circuit the fuse current rating should be minimum 2 times of the full load current.

23. **The capacitance of the capacitor is directly proportional to the_____**
    (a) Material of the plate
    (b) Area of the plate
    (c) Voltage across the plate
    (d) Polarity of the plates

Ans : (b) The capacitance of capacitor is directly proportional to the surface area of plates, and is inversely proportional to the separation between the plates.

■ **Capacitance is given by:-**

$$C = \frac{\varepsilon A}{d}$$

where,   C = Capacitance
         ε = Permittivity
         A = Area
         d = Separation between the plate

24. **In a four point earth tester (P1, C1, P2, C2) the points shorted and connected to fixed earth point are**
    (a) P1 – C1   (b) P2 – C2
    (c) P1 – C2   (d) C1 – P2

Ans : (a) In 4 point earth tester the current terminal (C1) and potential terminal (P1) are shorted and connect to earthing test electrode (A) under test.

25. **What is the value of resistivity of copper conductor**
    (a) 1.72 micro ohm meter
    (b) 1.72 micro ohm/cm^3
    (c) 1.72 micro ohm/m^3
    (d) 1.72 ohm/cm^3

Ans : (*) The resistivity of copper conductor is generally given as 1.72×10^{-8} Ω-m.
■ The resistivity of a particular material is measured in units of ohm-meters which is also affected by temperature.
Note- This question by Ayog is considered incorrect.

26. **You have to find true power, apparent power, reactive power and power factor of a 3 phase circuit. From which one of the following values can be determined?**
    (a) By 2 element type 3 phase wattmeter
    (b) By 2 wattmeter method
    (c) By 3 element 3 wire 3 phase wattmeter
    (d) By 3 element 4 wire 3 phase wattmeter

Ans : (b) 2-watt meter method are used to find out true power, reactive power, apparent power and power factor of 3-phase circuit.
■ Two wattmeter method and three wattmeter method are used for both balanced and unbalanced loads.
■ The one wattmeter method is used for the measurement of three phase power in case of balanced load only if is used for both star and delta connected load.

27. **The active material used on positive plates of lead acid cell is**
    (a) Pb   (b) PbO_3
    (c) PbO_2 (d) $PbSO_4$

Ans : (c) The active material on the positive plates of lead acid cell is lead peroxide (PbO_2), and the negative plate active material is called sponge lead (Pb).
■ The electrolyte is a diluted solution of sulfuric acid (H_2SO_4).
■ Chemical reaction of lead acid cell.
1. Discharging Time
On positive plate;
$PbO_2 + H_2 + H_2SO_4 \rightarrow PbSO_4 + 2H_2O$
On negative plate,
$Pb^{+2} + SO_4^{-2} \rightarrow PbSO_4$
2. At charging time
On positive plate,
$PbSO_4 + SO_2 + 2H_2O \rightarrow PbO_2 + 2H_2SO_4$
On negative plate,
$PbSO_4 + H_2 \rightarrow Pb^{+2} + H_2SO_4$
■ Potential voltage of fully charged lead battery is 2.1 to 2.6 V.
■ In lead acid battery, number of negative plate is more than one from number of positive plate.
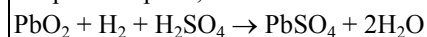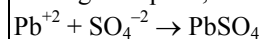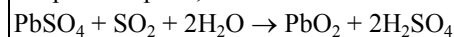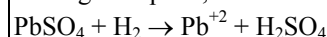
28. An appliance has a resistance of 100 ohms, takes 2 amperes. What is the power consumed by the appliance?
(a) 450 W   (b) 350 W
(c) 300 W   (d) 400 W

Ans : (d) Given that,
   R = 100 ohms
   i = 2 A
So, power consumed by circuit,
   $P = i^2R$
   $= 2 \times 2 \times 100$
   $\boxed{P = 400 \text{ W}}$

29. The capacitor start capacitor run motors have lesser efficiency and cannot take overloads. To avoid these problems capacitors of
(a) One large value used
(b) One low value used
(c) One medium value used
(d) One larger and one low value used

Ans : (d) The capacitor start capacitor run motor have lesser efficiency and can not take overloads to avoid this problem one large and one low value of capacitor is used.
- In capacitor start capacitor run motor, running capacitor made up of oil type of low capacity. Manufactured for continuous duty cycle.
- Starting capacitor made up of electrolytic type of high capacity. Manufactured for short duty cycle.
- Rating of starting capacitor is 10 to 15 times the running capacitor.

30. For motor circuit, fuses are rated as
(a) Twice the full load current of the motor
(b) Thrice the full load current of the motor
(c) Starting current of motor
(d) No load current of motor

Ans : (c) The fuse rating is normally based on the starting current of the motor draws. It depends on the HP rating.

31. What is the composition of steel and silicon in transformer core?
(a) Steel 97% and silicon 3%
(b) Steel 95% and silicon 5%
(c) Steel 93% and silicon 7%
(d) Steel 90% and silicon 10%

Ans : (a) The composition of steel is 97% and silicon is 3% in transformer core. A transformer's core is built of silicon steel magnetic flux can be carried by this iron core.
Note- This question by Ayog considered correct option is (c).

32. The current capabilities of the cables are specified for certain ambient temperature in BIS regulations. The specified ambient temperature is
(a) 20^0C   (b) 30^0C
(c) 40^0C   (d) 50^0C

Ans : (c) Ambient temperature rating refers to the relationship between the label power rating. Many manufactures list their power supply rating based upon a 40ºC ambient temperature.
- The current capabilities of the cable are specified for 40ºC ambient temperature.
- In general, a safe ambient temperature range is between 60-75 Fahrenheit or 15ºC to 24ºC, The cooler and of range is better.
- IEC standard specifies a maximum ambient temperature of 40ºC.

33. If the pointer moves quickly to its final deflected position without any sort of oscillation, that damping is called as
(a) Under damping   (b) Over damping
(c) Critical damping   (d) Air friction damping

Ans : (c) The critical damping is defined as threshold between over damping and under damping in case of critical damping, the pointer move to the equilibrium position as quickly as possible without oscillating.
- An over damped system moves slowly toward equilibrium and an under damped system moves quickly to equilibrium, but will oscillate about the equilibrium point as it does so.
- The damping ratio is a system parameter denoted by ξ (zeta)
if $\xi = 0$ system is undamped
if $\xi < 1$, system is under damped
if $\xi = 1$, system is critical damped
if $\xi > 1$, system is over damped.

34. A three phase synchronous motor will have _____ slip rings
(a) no.   (b) 1
(c) 2   (d) 3

Ans : (c) The stator of 3 phase synchronous motor is excited with a 3-ϕ supply while the rotor is excited by an external dc source and therefore, requires slip ring and brushed to provide current to the rotor hence there are two slip ring required in the rotor to provide dc supply.
- Synchronous motors are not self-starting motor. This property is due to the inertia of the rotor.
- A synchronous motor is called a doubly excited machine because both its rotor and stator are excited to achieve magnetic locking.

35. Which rule is applied to identify the direction of rotation of conductor in DC motor?
(a) Cock's screw rule
(b) Right hand grip rule
(c) Fleming's left hand rule
(d) Fleming's right hand rule

Ans : (c) The direction of rotation of the DC motor conductor can be determined by Fleming's left hand rule.

- According to this rule, if we arrange our thumb, forefinger and middle finger of the left hand perpendicular to each other them the thumb points towards the direction of the magnetic force. The forefinger points towards the direction of the magnetic field, and the middle finger points towards the direction of the current.
- Fleming's right hand rule is used in DC generator to determine the direction of induced current in the conductor.

36. What is the benefit of 5S system

    (a) Increase in manpower
    (b) Increase in economy
    (c) Increase in productivity
    (d) Reduction in pollution

Ans : (c) The benefit of 5S system is to increase in productivity.

The 5 step of 5S system is following:-

Step-1:- Short-separate items which are un-required and unwanted dispose unwanted items.

Step-2 Set in order:- Arrange all item based on place of requirement.

Step-3 : Shine:- Keep the workplace clean everyday follow preventive maintenance.

Step- 4 : Standardize:- Create visual indicators, sops and ensure training of all employees regularly.

Step-5 : Sustain:- Regular audits, internal competition, rewards and recognitions.

The benefits of implementing 5S are:

1. Clean and pleasant environment
2. Self discipline
3. Identify and eliminate wastes
4. Identify abnormalities
5. Improvement in safety
6. Improve qualify
7. Increase in productivity
8. Improve machine uptime

37. In protective scheme, relay functions as

    (a) Switching device   (b) Sensing device
    (c) Breaking device   (d) Isolating device

Ans : (b) A protection relay mainly works as a sensor. It may be found out the fault location and then signal the operation of the circuit breaker. The circuit breaker cuts off the faulty system from the rest of the system and the continuity of electrical supply is not hampered.

38. ELCBs are specially used to disconnect to supply under-_____

    (a) Short circuit condition
    (b) Ground fault condition
    (c) Open circuit condition
    (d) Over load condition

Ans : (b) ELCB are specially used to disconnect the supply underground fault condition.
- ELCB works on the principle of residual current.
- ELCB stand for earth leakage circuit breaker.

- If is used to directly detect current leakage to earth from an installation and cut the power.
- An ELCB must be always connect in the circuit at the entry of supply to load after energy meter.

39. Which type of looping method used less cable in wiring?

    (a) looping out from switch and ceiling
    (b) looping from switch rose
    (c) looping out from 3 plate ceiling rose
    (d) looping out with junction box

Ans : (c) Looping out from 3 plate ceiling rose is a type of looping method that is used less cable in wiring. In this system, three terminal ceiling roses needed.
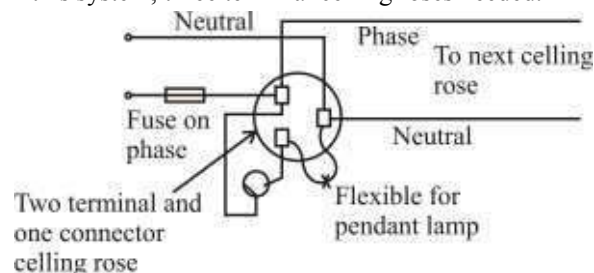
40. In an online UPS system, the switch over time mains to battery is

    (a) 10 milli seconds   (b) 9 milli seconds
    (c) 8 milli seconds   (d) Zero seconds

Ans : (d) In online UPS, the output power supply always stay on i.e. the UPS keeps charging the battery and draws current from the battery to supply load.

Hence, there is no switching and therefore, no time delay in switching between its source so in an online UPS system, the changing time from mains to battery is zero.

- In most offline UPS system, the changing time from mains to battery is between 2-10 ms. It can be as long as 25 but most shoot for sub 10 ms.

41. Which of the following frequencies has the longest time period?

    (a) 1 Hz   (b) 10 Hz
    (c) 1 kHz   (d) 100 kHz

Ans : (a) 1 Hz frequency has the longest time period.

A time period is the amount of time it takes for one complete cycle.

$$T \propto \frac{1}{f}$$

Time period of wave increases as its frequency decreases. So in given option, for 1Hz frequency has longest time period.

42. Which type of D.C. motor is used for elevators?

    (a) D.C. shunt motor
    (b) D.C. series motor
    (c) D.C. cumulative compound motor
    (d) D.C. differential compound motor

Ans : (c) Cumulative compound dc motor are used for elevator or lifts because it has variable speed, adjustable varying speed and high starting torque.

Example- Ball mills, reciprocating pump, punch and metal shears, compressors stamping machine etc.

DC shunt motor:- Used in lathes machine, vacuum cleaner, laundry washing machine, conveyors, grinder and small printing presses etc.

43. What defect will occur when the battery is over charged or discharged at a high rate?
(a) Sulphation (b) Buckling
(c) Local action (d) Partial short

Ans : (b) Buckling of battery plates refers to the bending of plates of the battery due to aging, sulphation etc. The charging and discharging of the lead-acid cell at a very high current than normal rate is the main cause of buckling.
■ Sulphation occurs when a lead acid battery is deprived of a full charge.

44. In Permanent magnet moving coil instrument, damping torque is provided by
(a) air friction (b) eddy current
(c) fluid friction (d) either a, b or c

Ans : (b) In PMMC type instruments, damping torque is provided by eddy current.

Type of damping	Instruments used
Air friction damping	Moving iron, electrodynmo meter type instruments, megger, energy meter
Fluid friction damping	Electrostatic voltmeter
Eddy current damping	PMMC, induction type

45. By providing compensating winding in series with armature of a D.C. generator which defect can be prevented?
(a) Rough commutation
(b) Cross magnetising effect
(c) Demagnetising effect
(d) Armature resistance drop effect

Ans : (b) Compensating winding are used in DC machine to neutralize the cross-magnetizing effect of armature reaction.

Inter poles:- The function of inter poles in a DC machine is to improve commutation.

Inter poles in DC machine has basically two functions:
(i) Automatic neutralization of cross-magnetization due to armature reaction.
(ii) To counter and cancel reactance voltage in the coil undergoing commutation.

Note-This question by Ayog considered correct option (c).

46. When two transformers are operating in parallel, they will share the load depending upon their_____
(a) Leakage reactance
(b) Magnetising current
(c) Per unit impedance
(d) kVA rating

Ans : (c) When two transformers are operating in parallel, they will share the load depending upon their per unit impedance.

Condition for parallel operation:-
1. The voltage ratio of transformers to be connected in parallel should be the same to avoid circulating current.
2. The ohmic value of the impedance of the transformer to be connected in parallel should be inversely proportional to respective kVA rating.
3. The X/R ratio of the transformer to be connected in parallel should be equal to avoid the operation of transformer at different power factor.

47. Candela is the limit of
(a) Luminous flux
(b) Luminous intensity
(c) Wave length
(d) None of the above

Ans : (b) Candela is the unit of luminous intensity.
■ The standard units of measurement defined by the ISU for the seven base quantities are SI base units.
■ 7 Basic SI units with their quantities.

Serial No.	Base quantities	Base SI units
1.	Length	Meter
2.	Mass	Kilogram
3.	Time	Second
4.	Electric current	Ampere
5.	Temperature	Kelvin
6.	Luminous intensity	Candela
7.	Amount of substance	Mole

48. UJT is also called
(a) Current controlled device
(b) Voltage controlled device
(c) Relaxation oscillator
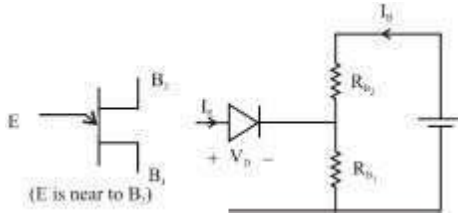(d) Voltage regulator

Ans : (c) UJT is also called relaxation oscillator.
UJT (Uni-Junction Transistor):-
■ It has one P-N junction.
■ It is 3 terminal device.
■ It is a current control device.
■ Double based Diode is UJT.

$$UJT = diode + two\ resistance$$

Symbol of UJT:–

(E is near to B₁)

Application of UJT:–
- Used as a relaxation oscillation
- Used as a voltage regulation
- Used as a timing circuit
- Used as a switching circuit

49. What is the relation between running winding and starting winding of a single phase induction motor with respect to resistance?
(a) both the resistances will be equal
(b) running winding is more than starting winding less
(c) running winding is less than starting winding more
(d) running winding is less than starting winding infinity

Ans : **(c)** A single phase motor consists of two winding, main windings and starting winding. Starting winding is also called auxiliary winding. The main winding is made of thick wires, thus has low resistance. However, the starting winding consists of thin wires having high resistance.
- Run/start capacitor are always connected in series with starting winding.
- The staring winding of 1-φ induction motor is placed in the stator by 90º apart from running winding.

50. Moving coil instrument works on the effect of
(a) chemical effect
(b) electro-magnetic effect
(c) heating effect
(d) electrostatic effect

Ans : (b) Moving coil instrument works on the effect of electromagnetic effect.
- In PMMC instruments, moving coil is wound with many turns of enrich cupper wire. The coil is mounted on a rectangular aluminium former which is pivoted on jeweled bearing.
- In PMMC, controlling torque is provided by phosphor-bronze hair springs. This spring also carries current, which is passing through the coil.

Advantage of PMMC instrument:-
(i) The scale is uniform
(ii) The power consumption is very low. i.e. 25 μW to 200 μW
(iii) The torque to weight ratio is high which gives a high accuracy
(iv) It is most accurate instrument.

Disadvantages:
(i) Cost is higher compared to MI type
(ii) It can not be used for AC.

51. In 1 kVA transformer, the number of turns per volt is 8. What is the number of turns in high voltage side, if the voltage is 110?
(a) 1920 (b) 880
(c) 192 (d) 125

Ans : (b) Given that,
Number of turns per volt = 8
So, number of turn for 110 V = 110×8
= 880 Turns

52. In squirrel cage induction motor, the rotor slots are slightly skewed in order to
(a) reduce windage losses
(b) reduce eddy currents
(c) reduce accumulation of dirt and dust
(d) reduce magnetic hum

Ans : (d) In squirrel cage induction motor, the rotor slots are slightly skewed in order to eliminate magnetic locking between the stator and rotor and to reduce magnetic hum.
- Induction motor also called asynchronous motor
- Induction motor is a transformer with a rotating short circuited secondary.
- At $N_r = N_s$, induction motor doesn't operate.
- In induction motor the number of stator slots should never be equal to rotor slots. Cogging can be easily overcome by making number of rotor slots prime to number of stator slots.
- **Crawling:-** The tendency of particularly squirrel - cage rotor to run as low as one seventh of their synchronous speed. This phenomenon is known as crawling of on induction motor.

53. What maintenance is carried out on machines and controls at regular intervals before machines develop trouble?
(a) Routine maintenance
(b) Periodical maintenance
(c) Preventive maintenance
(d) Break down maintenance

Ans : (c) Preventive maintenance is the regular and routine maintenance of equipment and assets in order to keep them running and prevent any costly unplanned downtime from unexpected equipment failure.
- Preventive maintenance includes regular and periodic (time based) schedules.
Corrective maintenance:- Occurs when an issue is noticed.
Predetermined maintenance:- Follows a factory scheduled.
Condition based maintenance:- Occurs when a situation or condition indicates maintenance is needed.

54. Which one of the following is the semiconductor
(a) Manganin (b) Silver
(c) Germanium (d) Ceramic

Ans : (c) Germanium is the semiconductor
Semiconductor:-
Material having resistivity or conductivity in between conductors and insulators, are called semiconductors.
■ These are the materials with the forbidden energy gap between valance and conduction band <3ev. It is less than that of insulators (>3ev) and more than that of conductors.
Example:-
Elemental Semiconductor:- Germanium, Silicon, Selenium, etc.
Compound Semiconductor:- Gallium, Indiun Phosphide, Cadmium sulphide etc.

55. Single phase capacitor start induction run motor is used in wet grinders. How will you connect the capacitor in wet grinder motor?
    (a) Series with starting winding
    (b) Series with running winding
    (c) Parallel with starting winding
    (d) Parallel with running winding

Ans : (a) In 1-ϕ capacitor start induction run motor, capacitor is always connected in series with starting winding used to generate a phase difference between the torques.
■ The starting capacitor is short time rated. It is electrotype a large amount of current is required to obtain the starting torque.
■ Hence the value of the capacitive reactance should be low in the starting winding.

56. Voltage drop in an alternator when under load is due to
    (a) armature resistance   (b) armature reactance
    (c) armature reaction   (d) all of the above

Ans : (d) The main reason for voltage drop in the alternator are:
1. Armature resistance:- The voltage drop caused by armature resistance per phase is IR_a.
where I is the phase current in ampere and R_a is armature resistance in ohm.
2. Armature leakage reactance:- When the load current flows through the armature winding it builds up the local flux which cut the winding and counter emf is generated. The effect produces armature reactance that is equal to $2\pi fL$.
This armature reactance is called leakage reactance X_L and this leakage flux is proportional to the armature current.
3. Armature reaction:- When the load current flows in the stator conductor, it produces a magnetic field which has cross-magnetizing effect, demagnetization effect and magnetizing effect upon the main flux due to field winding. Such an effect of armature current upon the main flux is known as armature reaction. The armature reaction depends upon the power factor of the load.

Synchronous reactance:- The combination of leakage reactance along with armature reaction is called as synchronous reactance.

57. A carbon-zinc cell with an internal resistance of 0.5 ohm and an EMF of 1.5 volt is loaded with an external resistor of 19.5 ohm. Calculate the current flowing through the circuit in mA ?
    (a) 82 mA   (b) 75 mA
    (c) 72 mA   (d) 60 mA

Ans : (b) Given that,
    Internal resistance of cell (r) = 0.5 ohm
    EMF of cell   = 1.5 volt
    Load resistance (R)   = 19.5 ohms
So, current in the circuit = $\dfrac{Total\,EMF}{Total\,resistance}$

$$= \frac{1.5}{0.5+19.5} = \frac{1.5}{20} = 0.075 \text{ A or 75 mA}$$

58. The diameter and axial length of rotors of a smooth cylindrical type rotors are-
    (a) small diameter and small axial length
    (b) large diameter and large axial length
    (c) small diameter and large axial length
    (d) large diameter and small axial length

Ans : (c) Cylindrical type rotor has small diameter and large axial length. The cylindrical type rotor is generally used for very high speed operation and employed in steem turbine or turbo generator.
■   Air gap is uniform in cylindrical type rotor.
Salient type rotor:- It is mainly used for low and medium speed it is used in hydropower plant.
■ The weight is more due to more number of poles, but more weight provides better mechanical stability.

59. Electrostatics is a branch of electricity concerned with
    (a) Energy flowing across a gap between conductors
    (b) Charges at rest
    (c) Charges in motion
    (d) Energy in the form of charges

Ans : (b) Electrostatic is the branch of electricity that deals with the study of the property of charge at rest.
We are not concerned with the movement of charges in electrostatics.

60. Single phase motor whose direction of rotation can not be changed by changing the connection is a
    (a) Capacitor start and run motor
    (b) Double capacitor motor
    (c) Repulsion induction motor
    (d) Universal motor

Ans : (c) Direction of rotation of repulsion induction motor can not be changed by changing the connection.
■ The direction of rotation depends on the position of the brushes if the brushes are shifted clock wise from the main magnetic axis, the motor will rotate in a clockwise direction. If the brushes are shifted counter clockwise from the main magnetic axis, the motor will rotate in a counter-clock wise direction.

61. The 3 phase armature windings are kept electrically apart by
(a) 60^0 (b) 90^0
(c) 120^0 (d) 180^0

Ans : (c) 3 phase armature winding are kept electrically apart by 120º
■ For 3 phase or more than 3 phase
Angle $(\theta) = \dfrac{360º}{n}$
■ 2 phase armature winding are kept electrically apart by 90º.

62. Direct online (DOL) Starters are not suitable for starting large DC motors.
(a) the motor may run away
(b) the starting torque becomes low
(c) the motor may not start
(d) the starting current will be enormously high

Ans : (d) While starting a motor using a DOL starter, the motor draws very high current compared to the full load current of the motor which may cause large voltage drop in the supply main. Hence DOL starter is used for very low power rating machine. Hence it is not suitable for large power rating DC machine.

63. Peak factor is the ratio of
(a) RMS value to Average value
(b) Peak value to RMS value
(c) Average value to Peak value
(d) Peak value to Average value

Ans : (b) Peak factor is defined as the ratio of the peak value to RMS value of an alternating quantity.

$$\text{Peak factor} = \dfrac{\text{Peak value}}{\text{R.M.S. value}}$$

Wave form	Peak value	Average value	RMS value	Form factor
Sinusoidal wave	A_m	$\dfrac{2A_m}{\pi}$	$\dfrac{A_m}{\sqrt{2}}$	$\dfrac{\frac{A_m}{\sqrt{2}}}{\frac{2A_m}{\pi}} = 1.11$
Square wave	A_m	A_m	A_m	$\dfrac{A_m}{A_m} = 1$
Triangular wave	A_m	$\dfrac{A_m}{2}$	$\dfrac{A_m}{\sqrt{3}}$	$\dfrac{\frac{A_m}{\sqrt{3}}}{\frac{A_m}{2}} = \dfrac{2}{\sqrt{3}}$
Half-wave rectified wave	A_m	$\dfrac{A_m}{\pi}$	$\dfrac{A_m}{2}$	$\dfrac{\frac{A_m}{2}}{\frac{A_m}{\pi}} = \dfrac{\pi}{2}$

64. In mercury vapour lamp, a resistor is connected in series with auxiliary electrode. What is the purpose of resistor connected to it?
(a) To limit the power factor
(b) To limit the starting current
(c) To limit the voltage
(d) To limit the energy

Ans : (b) In mercury vapor lamp to limit the starting current a resistor is connected in series with auxiliary electrode.
■ Generally high pressure mercury vapour lamp emits greenish - blue light.
■ Mercury vapor lamp is deficient in red light.
■ Efficiency is about 40 lumens per watt.
■ Color rendering is better than that of high pressure sodium lamp.
Uses: large areas like park, stadium lighting, high ceiling building and gyms.

65. Intrinsic semiconductor material is characterized by a valence shell of _____ electrons?
(a) 1   (b) 2
(c) 4   (d) 6

Ans : (c) Intrinsic semiconductor material is characterized by a valence shell of 4 electrons.
Intrinsic semiconductor:-
Intrinsic semiconductor are those type of conductors where the number of electrons is equal to the number of holes in that particular material.
Hence,
$$\eta_e = \eta_h = \eta_i$$
Where, η_e = number of electrons
η_i = intrinsic carrier concentration
η_h = number of holes
Properties of intrinsic semiconductor:-
■ An intrinsic semiconductor behaves like an insulator at T = 0K
■ It is a pure conductor.
■ It characteristic is temperature-dependent.
■ The density of electrons is equal to the density of holes.

66. A DC generator works on the principle of
(a) Faraday's law of electrolysis
(b) Fleming's left hand rule
(c) Len'z law
(d) Faraday's law of electromagnetic induction

Ans : (d) Primary function of DC generator is to convert mechanical energy into electrical energy. DC generator generates electricity using the principle of faraday's law of electromagnetic induction. When a conductor is placed in varying magnetic field, an EMF gets induced with in conductor.

67. The earth resistance tester works on the principle of
(a) potential dividing method
(b) fall of potential method
(c) fall of resistance method
(d) current dividing method

Ans : (b) The earth tester is also known as a ground resistance tester or earth resistance tester. It is an essential instrument used to determine the ground earth resistance and earth resistivity for grounding and earthing system.
- It is modified version of the megger
- Earth tester range from 0 to 50 ohms, 0 to 500 ohms, 0 to 1500 ohms and 0 to 3000 ohms etc.
- The earth grounding tester will generate a known current through the outer two electrodes and inner two will measure any drop in potential voltage. The tester then automatically calculates soil resistance using ohm's law.

68. Opening the switch of an inductive circuit sets an arc across the switch contacts due to large voltage induced and stored energy in magnetic field. The arc is surpassed in such circuits by connecting
(a) a capacitor across the supply
(b) a capacitor across the switch contacts
(c) arcing horns across the switch contacts
(d) another small inductor across the switch contacts in reverse direction

Ans : (b) When a switch of an inductive circuit is opened, an arc developed across the contacts. To prevent this arc a capacitor is connected across the switch contacts.
How are suppression work:
1. When the contacts in an arc suppression circuit is open, the applied voltage is placed across the capacitor and not the contacts.
2. The capacitor charges at a rate faster than the contact open which prevent an arc from forming across the contacts.

69. Which type of fire extinguisher must not be used for electrical base fire?
(a) Halon extinguisher
(b) Carbon tetra chloride (CTC extinguisher)
(c) Foam extinguisher
(d) Dry powder extinguisher

Ans : (c) Soda acid and foam-type extinguishers are solutions prepared in water, which conducts electricity. As a result, it might generate an electric shock leading to short-circuiting and start another fire. Hence, they are not used to extinguish electrical fires.

70. A 3 phase full wave rectifier has an AC input of 415 V, 50 Hz. The ripple frequency of D.C. output in pulses per second is
(a) 50   (b) 100
(c) 150   (d) 300

Ans : (d) Given that,
$$f_{in} = 50 \text{ Hz}$$
So, 3 phase full wave rectifier
$$f_{out} = 6 \times f_{in}$$
$$= 6 \times 50$$
$$= 300 \text{ Hz}$$

71. The algebraic sum of the currents meeting at any junction of network is zero. What is the name of law?
(a) Kirchhoff's voltage law
(b) Ohm's law
(c) Coulomb's law
(d) Kirchhoff's current law

Ans : (d) According to Kirchhoff's current law "the algebraic sum of the current meeting at any junction of network is zero".
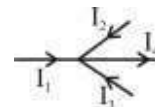
According to Kirchhoff's law
$$I_4 = I_1 + I_2 + I_3$$
- It follows the charge of conservation.
- KVL is based on the law of conservation of energy.
- KCL and KVL are applicable to lumped network.

72. The RMS value of sinusoidal alternating current is given by the relation
(a) I (max)2   (b) 0.6371 (max)
(c) 2 I (max)/Pi   (d) I (max)/ square root 2

Ans : (d) The rms value of sinusoidal alternating current is $\dfrac{I_{max}}{\sqrt{2}}$

	Sinusoidal wave	Rectangular wave
RMS value	$\dfrac{V_{max}}{\sqrt{2}}$	V_{max}
Average value	$\dfrac{2V_{max}}{\pi}$	V_{max}
Form factor	1.11	1
Peak factor	1.41	1

73. The function of diode can be compared with that of a _____
(a) fuse   (b) relay
(c) coil   (d) switch

Ans : (d) The function of diode can be compared with that of a switch.
Diode:-
- Diode is a semiconductor device that essentially acts as a one-way switch for current.
- A diode is a specialized electronic component with two electrodes called the anode and cathode.
- Diodes can be used as rectifiers, signal limiters, voltage regulators, switches, signal modulators etc.

Symbol of Diode:-

Anode (A)   Cathode (K)
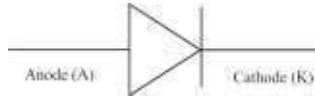
Important point:-
- Diode is a Uni-Directional device.
- Diode is a non-linear device.
- Diode is a active device.
- Diode is an example of Non-ohmic device.

74. Which artificial resuscitation method is suitable to the victim in the case of burns/injury in the back?
(a) Mouth to mouth method
(b) Schafer's method
(c) Nelson's method
(d) Holgen-Nelson method

Ans : (c) Nelson's method is suitable to the victim in the case of burns/injury in the back.
- Holgen-Nelson method is also known as Schaffer's method. This method is used when victim of electric shock is unconscious and not breathing. In this method, mouth is closely tightened.
- Mouth to mouth method is used when injury/burns to chest or belly.

75. Fire is a combination of
(a) fuel, light and oxygen
(b) fuel, heat and oxygen
(c) fuel, heat and carbon dioxide
(d) fuel, light and nitrogen

Ans : (b) Fire is a combination of fuel, heat and oxygen.
- Fire is the rapid oxidation of a material (the fuel) in the exothermic chemical process of combustion, releasing heat, light and various reaction products.

76. The delta connected secondary of a transformer is connected to a delta connected load. Any unbalanced current will _____
(a) return back through neutral link
(b) disconnect the load automatically
(c) automatically vanish after some time
(d) circulate around delta connected load

Ans : (d) The delta connected secondary of a transformer is connected to delta connected load as we know that unbalanced loading is cause of a circulating current.

77. The reason for the stator core of an alternator is made up of laminated sheets is to_____
(a) increase the eddy current losses
(b) reduce the eddy current losses
(c) increase the magnetic flux
(d) decrease the speed of the rotor

Ans : (b) According to faraday's law of induction, eddy currents are loops of electrical current induced within conductors by a changing magnetic field.
- The stator core of an alternator is laminated to reduce eddy current losses and improve efficiency.

78. The copper loss of the transformer during the maximum efficiency is 1000 watts, what will be the iron loss?
(a) 1200 watts   (b) 1000 watts
(c) 900 watts   (d) 800 watts

Ans : (b) The copper loss of the transformer is a variable loss, which is vary with respect to load changes.
- The condition for max efficiency of a transformer is whenever copper losses are equal to the iron losses.
At maximum efficiency-
Copper loss = Iron loss
Hence, iron loss (P_i) = 1000 watt.

79. The following is a Bi-polar device
(a) IGBT   (b) GTO
(c) both a and b (d) None of the above

Ans : (c) IGBT and GTO are a bipolar device.
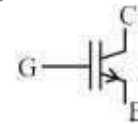**IGBT (Insulated Gate Bipolar Transistor)**
- It is also called metal Oxide Insulated Gate Transistor (MOSIGT).
- It is also called Conductivity Modulated Field Effect Transistor (COMFET).
- IGBT has been developed by combining into it the best quality of both BJT and MOSFET.
- IGBT has high input impedance like a MOSFET.
- IGBT's are Gate, Emitter and Collector terminals.

$$IGBT = MOSFET + BJT$$

- IGBT is voltage controlled device.
GTO (Gate Turn off Transistor)
- It has 4 layer, 3 Junction and 3 terminal device. A GTO is a PNPN Diode that can be turn ON By a +ve gate current and turn off by a –ve gate current at its gate cathode terminal.
- The self turn off capability of GTO make it the most suitable device for inverter and chopper.
- A device with combined properties of thyristor and transistor is GTO.

$$GTO = Thyristor + Transistor$$

Symbol:-
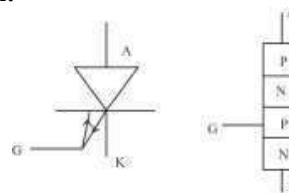
80. The cross section of chisel is usually
(a) hexagonal   (b) Rectangular
(c) Octagonal   (d) Square

Ans : (c) Cross-section of chisel is usually octagonal.
- Cold chisels are used for cutting metal they are made from high carbon steel, hardened and tempered at the cutting ends.
- Hot chisel can be made from medium carbon steel as it does not need much hardening of its cutting edge.

ISRO (NRSC) Exam, 2023
Technician-B (Electrician)
Solved Paper

1. **What should be the clearance of lowest conductor above ground across street for high voltage Lines as per I.E. rules?**
   (a) 6.5m   (b) 6.1m
   (c) 5.8 m   (d) 5.5 m

Ans. (b) : Indian electricity rules of 1956, the minimum clearance above ground of the lowest conductor for high voltage lines across a street should be 6.1 meter.
■ **Clearance above ground of the lowest conductor-**

Types of line	Height (m)
Low voltage line	5.8
Medium voltage line	5.8
High voltage line	6.1

2. **What is the primary function of a Miniature Circuit Breaker (MCB) in an electrical circuit?**
   (a) Resistance control   (b) Current interruption
   (c) Voltage regulation   (d) Signal transmission

Ans. (b) : Current interruption is the primary function of a miniature circuit breaker in an electrical circuit.
■ **Types of circuit breakers-**
(i) Air blast circuit breakers
(ii) Vacuum circuit breakers
(iii) Oil circuit breakers
(iv) Sulphur hexafluoride (SF_6) circuit breakers

3. **Why is it essential for a synchronous motor to be initially started as an induction motor?**
   (a) To maintain constant initial inertia
   (b) To reduce power consumption
   (c) To minimize stator losses
   (d) To achieve synchronous speed

Ans. (d) : A synchronous motor needs to be started initially as an induction motor because in order to attain synchronous speed.
■ **Starting method is used in synchronous motor-**
(i) Damper winding
(ii) Small DC machine
(iii) Pony motor

4. **In an AC circuit, the RMS (Root Mean Square) value is related to the peak value by which of the following factors?**
   (a) 0.5   (b) π (c) $\sqrt{2}$ (d) 2

Ans. (c) : In an AC circuit, the RMS value is related to the peak value by $\sqrt{2}$.

■ $V_{rms} = \dfrac{V_m}{\sqrt{2}}$

■ Peak factor $= \dfrac{V_{max}}{V_{rms}}$

■ Form factor $= \dfrac{V_{rms}}{V_{avg}}$

5. **Which type of protection is responsible for shutting down the inverter in case of excessive temperature?**
   (a) Over current protection
   (b) Surge protection
   (c) Thermal protection
   (d) Voltage regulation

Ans. (c) : Thermal protection is responsible for shutting down the inverter in case of excessive temperature.
■ The thermal protection circuit will trigger and shut down the inverter to prevent damage
■ **Advantage of thermal protection -**
(i) Prevention of over rating damage.
(ii) Reduced risk of electrical fires
(iii) Improved overall reliability and performance of the system.
(iv) Protection of sensitive components.

6. **In a Star-Delta motor starter, which configuration is used during the starting period?**
   (a) Delta only
   (b) Both Star and Delta simultaneously
   (c) Star only
   (d) Neither star nor delta

Ans. (c) : Star configuration is used during the starting period in a star-delta motor starter.
■ **Three types of starter are used in motor-**
(i) Direct online starter
(ii) Star-delta starter
(iii) Auto- transformer
■ **The main function of a motor starter is -**
(i) To easy and safely start or stop a motor.
(ii) To protect the motor from overcurrent and low voltage.

7. **During the installation of a synchronous motor, why is it crucial to properly set the excitation voltage and frequency?**
   (a) To maintain synchronous speed
   (b) To enhance motor speed
   (c) To minimize electrical noise
   (d) To reduce motor size

Ans. (a) : To maintain synchronous speed the excitation voltage and frequency must be set properly during installation of the synchronous motor.
■ Synchronous motor is not self started.
■ It is operate at leading, lagging and unity power factor.
■ Synchronous motor is known as a doubly- excited machine.
■ It works on 3-ϕ AC and DC both.
Formula-

$$N_s = \dfrac{120f}{P}$$

Where,

N_s = Synchronous speed
f = Supply frequency
P = Pole

8. **Which of the following materials is commonly used for creating effective earthing connections in electrical installations?**
(a) Glass
(b) Rubber
(c) Plastic
(d) Copper

Ans. (d) : Copper material is commonly used for creating effective earthing connection in electrical.
Earthing - The process of connecting the metallic part of electrical equipment to earth is called earthing.
■ It is also called grounding
■ Electrical outlet has three contacts-
(i) One for line wire
(ii) One for neutral wire
(iii) One for ground wire
■ Earthing is used for safety of human, birds and animals.

9. **In audio systems and electronic devices, which type of transformer is often employed to match impedance between different components?**
(a) Instrument Transformer
(b) Audio Transformer
(c) Power Transformer
(d) Auto- Transformer

Ans. (b) : In audio system and electronic devices an audio transformer is often employed to match impedance between different components.
■ **Audio transformer are designed to-**
(i) Step up or step down voltage level
(ii) Match the impedance of different devices
(iii) Isolate different circuit
(iv) Block DC voltage
Application-
(i) Audio Amplifiers
(ii) Speakers
(iii) Radio transmitters and receivers

10. **What does the term "kVA rating" indicate in a transformer specification?**
(a) The efficiency of the transformer in converting electrical power
(b) The total weight of the transformer
(c) The maximum temperature at which the transformer can operate
(d) The apparent power capacity of the transformer

Ans. (d) : The term kVA rating indicate the apparent power capacity of the transformer.
■ The term MVA rating indicate the large transformer.
■ **kVA rating is a measure of the transformer-**
(i) Current capacity
(ii) Voltage capacity
(iii) Power handling capability.

11. **What is the frequency of a waveform that completes 10 cycles in 2 seconds?**
(a) 10Hz
(b) 5Hz
(c) 20Hz
(d) 2Hz

Ans. (b) : Given that,

Cycles = 10
time = 2sec
frequency = ?

Formula,

$$frequency = \frac{Cycles}{time(sec)}$$

$$frequency = \frac{10}{2}$$

$$\boxed{frequency = 5Hz}$$

12. **In which scenario is it mandatory to use double insulation for electrical appliance in India?**
(a) Low - voltage appliances
(b) Appliances used near water sources
(c) Appliances used in dry conditions
(d) Appliances with metal casing

Ans. (b) : Appliances used near water source scenario is mandatory to use double insulation for electrical appliance in India.
■ For double - insulated appliance the outer casing is made of insulator.
■ The plastic casing acts as a second layer of protection of insulation.
■ Symbol of the double insulation.
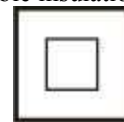
13. **How does a voltage stabilizer maintain a constant output voltage?**
(a) By regulating the output current
(b) By generating electrical power
(c) By adjusting the input voltage
(d) By storing excess voltage

Ans. (c) : The voltage stabilizer maintain a constant output voltage by adjusting the input voltage.
■ **Advantage of voltage stabilizer-**
(i) Improved power quality
(ii) Protecting electrical equipment from voltage surge and voltage fluctuation.
(iii) It can filter out electrical noise.

14. **What is the recommended interval for regular maintenance of complete gaseous fire-extinguisher system that do not incorporate means to determine container contents, as per Indian standard?**
(a) Six-monthly
(b) Yearly
(c) Monthly
(d) Weekly

Ans. (a) : Six monthly the recommended interval for regular maintenance of complete gaseous fire-extinguisher system that do not incorporate means to determine container contents, as per Indian standard.
■ **Six monthly maintenance for fire-extinguisher-**
(i) Cleaning and lubricant
(ii) Checking of nozzle and blockage.
(iii) Check the extinguisher for damage corrosion
(iv) Pressure gauge check
(v) Label check

15. **Which of the following is a type of DC motor commonly used for applications where a constant speed is required, such as in fans and blowers?**
(a) Permanent magnet motor
(b) Series motor
(c) Shunt motor
(d) Compound motor

Ans. (c) : Shunt motor is commonly used for application where a constant speed is required such as in fans and blowers.

■ DC shunt motor speed is fairly constant and requires medium starting torque.

Application-
(i) Lathe machines
(ii) Fan and blowers
(iii) Drilling machine
(iv) Milling machine

16. What is the primary purpose of connecting a UPS (Uninterruptible Power Supply) to a computer system?
    (a) To increase the processing speed of the computer
    (b) To provide temporary power during electrical outages
    (c) To enhance the audio output of the computer
    (d) To improve internet connectivity

Ans. (b) : The primary purpose of connecting a uninterruptible power supply to a computer system is to provide temporary power during electrical outages.

■ **Advantage of UPS –**
(i) Protect to data loss due to sudden power loss.
(ii) Prevent damage to hardware system from power surges.
(iii) Provide short-circuit protection
(iv) Provide to over-voltage and under voltage protection.

17. How does the speed of a DC generator change in response to an increase in load?
    (a) The speed remains constant
    (b) The speed fluctuates randomly
    (c) The speed decreases
    (d) The speed increases

Ans. (c) : The speed of a DC generator decreases in response to an increase in load.
■ DC generator, converts mechanical power to electrical power.
■ DC generator commutator is known as mechanical rectifier.

18. What happens to the rotor speed in a slip ring induction motor when the external resistance connected to the rotor circuit is increased?
    (a) Rotor speed remains constant
    (b) Rotor speed increases
    (c) Rotor speed becomes zero
    (d) Rotor speed decreases

Ans. (d) : When the external resistance connected to the rotor circuit of a slip ring induction motor is increased the rotor speed decreases.

■ **Slip - ring induction motor-**
(i) Starting torque is high but running torque is low.
(ii) Rotor resistance starter is used.
(iii) Speed control by rotor resistance is possible.
(iv) Three slip rings and three brushes are used.

■ **Application-**
(i) Elevators
(ii) Cranes
(iii) Lift
(iv) Hoists

19. What is the purpose of sectionalizing switches in a distribution network?
    (a) To protect against over current
    (b) To regulate voltage levels
    (c) To control power factor
    (d) To isolate faulty sections for maintenance

Ans. (d) : The purpose of sectionalizing switches in a distribution network is to isolate faulty sections for maintenance.

■ **Main purpose of sectionalizing switches-**
(i) Improve reliability
(ii) Reduce outage time
(iii) Enhance maintainability
(iv) Optimize network reconfiguration.

**20. In a radial distribution system, how is the feeder arrangement characterized?**
    (a) Feeder lines are connected in series
    (b) Feeder lines are connected in parallel
    (c) Feeder lines form a closed loop
    (d) Feeder lines radial form a central point

Ans. (d) : In a radial distribution system the feeder arrangement is characterized by the feeder lines radial form a central point.

■ **There are three types of distribution system-**
(i) Radial system
(ii) Ring main system
(iii) Interconnected system

1. Radial system-
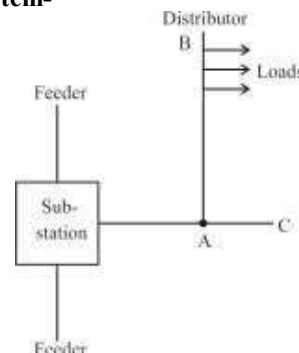
(i) The end of the distributor nearest to the feeding point will be heavily load.
(ii) This is the simplest distribution circuit.
(iii) This system is used for short distance only.
(iv) Lowest initial cost.

21. Which of the following is a characteristic feature of a semiconductor fuse?
    (a) High interrupting capacity
    (b) Replaceable element
    (c) Suitable for high-voltage applications
    (d) Rapid response time

Ans. (d) : Rapid response time is a characteristic feature of a semiconductors fuse.

■ **The main features of semiconductors fuses.**
(i) High speed
(ii) Over current protection
(iii) Over voltage protection
(iv) High breaking capacity
(v) Small size
(vi) Fast response time
(vii) High reliability

22. In semiconductor technology, what is the purpose of the doping process?
   (a) To increase the mechanical strength of the semiconductor
   (b) To introduce impurities and modify the electrical properties of the semiconductor
   (c) To enhance the colour of the semiconductor material
   (d) To improve the thermal conductivity of the semiconductor

Ans. (b) : In semiconductor technology, the purpose of the doping process is to introduce impurities and modify the electrical properties of the semiconductor.
Doping - The process of adding of impurity into pure semiconductor.
■ Doping increases carrier concentration.
■ There are two main types of doping.
(1) **N-type doping** - Introduces donor impurities, which release excess electrons, creating a region with a majority of electrons.
(2) **P-type doping** - Introduces acceptor impurities, which create holes (positive charge carrier) creating a region with a majority of holes.

23. In what application is an EX-OR gate commonly used in communication systems?
   (a) Demodulation
   (b) Frequency modulation
   (c) Multiplexing
   (d) Error detection and correction

Ans. (d) : An EX-OR gate commonly is used in communication systems in application of error detection and correction.
EX-OR gate application-
(1) Error detection and correction
(2) Digital encryption
(3) Data compression
(4) Digital signatures
(5) Random number generation
(6) In digital logic circuit
(7) Code converters
(8) Arithmetic circuits

24. What is the purpose of brushes in an electric motor or generator?
   (a) To maintain a continuous electrical contact with the commutator or slip rings
   (b) To control the temperature of the motor
   (c) To provide mechanical support to the rotating components
   (d) To clean the commutator or slip rings

Ans. (a) : The purpose of brushes in an electric motor is to maintain a continuous electrical contact with the commutator or slip-ring.
■ **The main purpose of brushes-**
(i) It is a stationary part of DC machine
(ii) Brushes are made of carbon.
(iii) Carbon brushes provides self lubrication also.
(iv) Copper brushes are used for low voltage and high current.
(v) Graphite brushes are preferred for low current and high voltage.

25. Which type of fire extinguisher is suitable for combating electrical fires?
   (a) Class C
   (b) Class A
   (c) Class D
   (d) Class B

Ans. (c) : Class D types of fire extinguisher is suitable for combating electrical fire.

Class of fire	Types of fire	Remedy of fire fighting
Class - A	Ordinary combustibles Ex- Wood, paper, cloth	Water, Sand
Class - B	Oil or liquids Ex- Diesel, petrol etc.	Foam, CO_2
Class - C	Flammable gases Ex- LPG etc.	CO_2, Helon
Class- D	Electric fire	CTC, Dry Sand

26. Which type of fire extinguisher is suitable for use on fires involving flammable liquids such as gasoline or oil?
   (a) Class A
   (b) Class C
   (c) Class B
   (d) Class D

Ans. (c) : Class-B type of fire extinguisher is suitable for use on fires involving flammable liquids such as gasoline or oil.

Class of fire	Remedy of fire fighting	Types of fire
Class - A	Water, foam, dry powder	Wood, paper and textiles etc
Class - B	Foam, Carbon - dioxide	Flammable liquids
Class - C	CO_2, Helon	Flammable gasses
Class- D	CTS, Dry sand	Electric fire
Class - F	Wet chemical	Cooking oil

27. What happens to the speed of a three - phase induction if the stator voltage is increased?
   (a) Speed increases
   (b) No change in speed
   (c) Depends on the load
   (d) Speed decreases

Ans. (a) : If the stator voltage is increased then the speed of a three phase induction motor is increased because-
■ In induction machine, the speed of rotor is directly proportional to supply voltage.
■ Speed control by supply voltage method speed is obtained below base speed or rated speed.

28. What does RMS stand for in the context of electrical signals?
   (a) Relative Magnitude and Size
   (b) Real Mean Squared
   (c) Random Measurement Standard
   (d) Root Mean Square

Ans. (d) : RMS stand for root mean square in the context of electrical signals.
■ **Root Mean Square (RMS)-** Root Mean Square (RMS) value of AC is defined as that value of steady current, which would generate the same amount of heat

in a given resistance in a given time, as is done by the AC when passed through the same resistance for the same time.

■ The RMS value is also called effective value of AC or virtual value of AC.

■ $$I_{rms} = \frac{I_m}{\sqrt{2}} \qquad V_{rms} = \frac{V_m}{\sqrt{2}}$$

29.   Why is monitoring the battery level important in an inverter system?
   (a) To increase the efficiency of connected devices
   (b) To reduce the voltage supplied by the inverter
   (c) To enhance the inverter's cooling system
   (d) To prevent overcharging of the battery

Ans. (d) : To prevent over charging of the battery the monitoring of the battery level is important in an inverter system.
Monitoring the battery level in an inverter system is crucial for several reasons-
■ Prevents overcharge/ over - discharge
■ Optimizes performance
■ Reduces downtime
■ Enhance safely
■ Enables maintenance scheduling

30.   What is the primary function of an MCCB (Molded Case Circuit Breaker) in an electrical circuit?
   (a) Current Amplification
   (b) Signal Transmission
   (c) Voltage Regulation
   (d) Over current Protection

Ans. (d) : The primary function of an MCCB (Molded Case Circuit Breaker) in an electrical circuit is to protect the over current protection.
■ It is a type of electrical protection device that can be used for a wide range of voltage and frequencies of both 50Hz and 60Hz.
■ The wide range of current ratings available from MCCB allows them to be used in a wide variety of application.
■ MCCB are available with current rating that range from low values such as 15 A to industrial rating such as 2500A.

31.   Which of the following is NOT a method commonly used for speed control of a three-phase induction motor?
   (a) Frequency Control
   (b) Rotor Resistance Control
   (c) Stator Voltage Control
   (d) Flux Control

Ans. (d) : Flux Control is NOT a method commonly used for speed control of a three-phase induction motor.
The speed of the induction motor can be controlled by the following method.
1. Frequency control.
2. Changing the number of stator poles.
3. Controlling supply voltage.
4. Rotor resistance control.

32.   In a DC motor starter, what is the function of the "plugging" operation?
   (a) To regulate the speed of the motor
   (b) To protect the motor from voltage fluctuations
   (c) To initiate the motor startup sequence
   (d) To reverse the direction of motor rotation

Ans. (d) : In a DC motor starter, the function of the plugging operation is to reverse the direction of motor rotation.
■ Plugging is a method used in DC motor to quickly reverse the direction of rotation by applying reverse voltage to the armature.
■ Plugging is used to reduce the speed of motors.
■ During plugging external resistance is also introduced into the circuit to limit the flowing current. Thus the armature current is reversed and high braking torque is produced.

33.   What is the primary characteristic of the positive half cycle of an alternating current (AC) waveform?
   (a) Current flows in one direction
   (b) Resistance is at its maximum
   (c) Voltage is zero
   (d) Electrons move in a random fashion

Ans. (a) : Current flows in one direction is the primary characteristic of the positive half cycle of an alternating current (AC) waveform.
**In a AC waveform during the positive half cycle-**
1. **Direction of current/voltage** - The current or voltage flows in one direction, typically from zero crossing to a positive peak.

34.   For an AND gate with inputs A and B and a single output Q, we will have a 1 output, when and only when:
   (a) A = 0, B = 0   (b) A = 1, B = 0
   (c) A = 0, B = 1   (d) A = 1, B = 1

Ans. (d) : For an AND gate with input A, B and a single output Q, we will have a 1 output, when and only when A = 1, B = 1
AND Gate: If both the input are high, it produces a high output.

AND gate
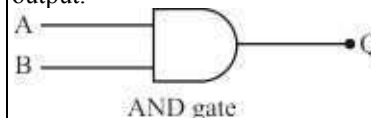
Q = AB
Truth Table:

Input		Output
A	B	Q=AB
0	0	0
0	1	0
1	0	0
1	1	1

35.   What should you do if you find a broken or damaged power wire on your domestic appliance?
   (a) Water should be sprayed on the card to prevent further damage
   (b) Ignore this and continue using the appliance

(c) The wire must be replaced immediately to avoid electrical shock

(d) Covering it with tape for a temporary fix

Ans. (c) : The wire must be replace immediately to avoid electrical shock if a damaged wire is on the domestic instrument.

■ Wire should be properly insulated to avoid dangerous shocks.

■ Electrical instrument used in domestic should be properly earthed.

36. **What type of impurities are added to a semiconductor to create an N-type extrinsic semiconductor?**

(a) Gallium   (b) Silicon

(c) Boron   (d) Phosphorus

Ans. (d) : Phosphorus impurities are added to a semi-conductor to create an N-type extrinsic semiconductor.

N-type semiconductor -

■ An N-type semiconductor is an intrinsic semiconductor doped with phosphorus (P), arsenic (As), antimony (Sb) as an impurity.

■ If a small amount of phosphorus is added to a pure silicon crystal, one of the valence electron of phosphorus becomes free to move around as majority electron. When this free electron is attracted to the positive electrode and moves current flow.
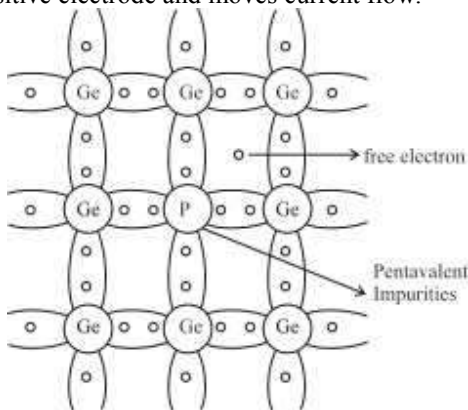
N-type extrinsic semiconductor

37. **In a half-wave rectifier circuit, what is the purpose of the diode?**

(a) To regulate the voltage

(b) To convert AC to DC

(c) To amplify the signal

(d) To control the current flow

Ans. (b) : In a half wave rectifier circuit, the purpose of the diode is to convert AC to DC.

■ A half wave rectifier is a rectifier circuit the converts alternating current to direct current and allow only half of the AC cycle to pass through it using diodes.

■ Peak inverse voltage of half wave rectifier is V_m.

■ Maximum efficiency of half wave rectifier 40.6%

A. C. Input
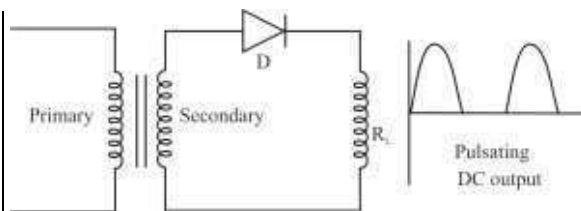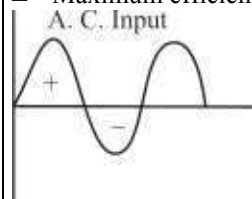
Half Wave Rectifier

■ Ripple factor of half wave rectifier is 1.21.

38. **What is the primary function of a fuse in an electrical circuit?**

(a) To amplify the power factor

(b) To interrupt the circuit in case of excessive current

(c) To increase the flow of current

(d) To regulate voltage

Ans. (b) : The primary function of a fuse in an electrical circuit to interrupt the circuit in case of excessive current.

■ An electric fuse is a safety device which limits the current flowing in an electric circuit.

■ When the current in the circuit increased beyond the limit fuse burn and save different electrical appliances.

■ The wire used in electric fuse is made up of an alloy of lead and tin.

■ Fuse wire has resistance with a low melting point.

39. **In a three-phase transformer, what is the significance of the delta (Δ) and wye (Y) configuration?**

(a) They indicate the type of cooling system used

(b) They represent the transformer's efficiency

(c) They define the connection of the primary and secondary windings

(d) They determine the transformer's physical orientation

Ans. (c) : In three phase transformer the significance of the delta (Δ) and wye (Y) configuration is to define the connection of the primary and secondary windings.

■ **Three phase transformers connection-**

Primary configuration	Secondary configuration
Delta (mesh) Δ	Delta (mesh) Δ
Delta (mesh) Δ	Star (wye) Y
Star (wye) Y	Delta (mesh) Δ
Star (wye) Y	Star (wye) Y
Interconnected star ⌐	Delta (mesh) Δ
Interconnected star ⌐	Star (wye) Y

40. **What is the correct technique for using a fire extinguished**

(a) Aiming the nozzle directly at the flames

(b) Spraying the fire extinguisher in a circular motion

(c) Pointing the nozzle towards the base of the fire and moving it from side to side

(d) Holding the fire extinguisher upside town when discharging

Ans. (c) : The correct technique for using a fire extinguisher is that pointing the nozzle towards the base of the fire and moving it from side to side.

■ A simple fire extinguisher training technique to use with employees is the P.A.S.S. method.

P = Pull the pin on the extinguisher.

A = Aim the nozzle of the fire extinguisher low toward the base of the fire.

S = Squeeze the handle to release the extinguishing agent.

S = Sweep the nozzle from side to side at the base of the flames until extinguished.

41. When connecting three-phase transformers in parallel, why it is crucial to ensure that the phase angles between the primary and secondary windings are identical?
   (a) To maximize efficiency
   (b) To simplify the connection process
   (c) To increases the overall power rating
   (d) To avoid circulating currents

Ans. (d) : When connecting three phase transformers in parallel. It is crucial to ensure that the phase angle between the primary and secondary winding are identical to avoid circulating currents.

Condition for parallel operation of transformer-
1. Same voltage and turns ratio.
2. Same percentage impedance and X/R ratio.
3. Identical position of tap changer.
4. Same kVA ratings.
5. Same phase angle shift.
6. Same frequency rating
7. Same polarity.
8. Same phase sequence.

42. What is the term used to describe the process where a small input signal controls a larger output signal in a transistor amplifier?
   (a) Reduction   (b) Multiplication
   (c) Attenuation   (d) Amplification

Ans. (d) : The term used to describe the process where a small input signal controls a larger output signal in a transistor amplifier is amplification.

■ A transistor is composed of three layers of semiconductor materials or more specifically terminals which help to make a connection to an external circuit and carry the current.

■ **There are three terminals for a transistor-**
1. **Base**- This is used to activate the transistor
2. **Collector** - It is the positive lead of the transistor
3. **Emitter**- It is the negative lead of the transistor.

43. When two objects with different electric charges are brought close to each other, what is the most likely outcome?
   (a) Repulsion
   (b) Attraction
   (c) Both attraction and repulsion
   (d) No effect

Ans. (b) : When two objects with different electric charges are brought close to each other. The most likely outcome will be attraction.

■ We know that like charges repel and unlike charges attract each other.

44. What is the correct way to determine if a fuse is blown or faulty?
   (a) Visually inspect the fuse for discoloration or a broken filament
   (b) Measure the resistance of the fuse with a multimeter
   (c) Smell the fuse for any burnt odor
   (d) Shake the fuse to listen for loose components

Ans. (a) : If a fuse is blown or faulty visually inspect the fuse for discoloration or a broken filament.

■ **To determine if a fuse is blown or faulty, you can follow these steps-**
(i) Visual inspection
(ii) Continuity test
(iii) Voltage test
(iv) Physical test
(v) Replacement

45. When performing insulation resistance testing, what is the typical unit of measurement used for expressing insulation resistance?
   (a) Volts (V)   (b) Amperes (A)
   (c) Ohms (Ω)   (d) Farads (F)

Ans. (c) : When performing insulation resistance testing the typical unit of measurement used for expressing insulation resistance is ohms (Ω).

■ Insulation resistance is measured by megger.

■ The unit of voltage is volt.

■ The unit of capacitor is farads.

46. What is the recommended technique for using fire blankets extinguish a person caused to fire?
   (a) Waving a fire blanket in the air to create a between the person and the flames
   (b) Wrap the person tightly in a fire blanket
   (c) Putting out the flames by gently placing a fire blanket over the person
   (d) Leaving a fire blanket on the floor and directing the person to roll on it.

Ans. (c) : The recommended technique for using a fire blanket to extinguish a fire on a person's clothing putting out the flames by gently placing a fire blanket over the person.

47. In which operating regions does a transistor act as a switch in electronic circuits?
   (a) Saturation and cutoff
   (b) Active and cutoff
   (c) Saturation and active
   (d) Linear and saturation

Ans. (a) : Saturation and cutoff operating region act as a switch in electronic circuit for transistors.

■ **Transistor biasing-**

JE	JC	Regions of biasing
F.B	R.B	Active region
F.B	F.B	Saturation region (Work act as switch)
R.B	R.B	Cut off region (Work act as switch)
R.B	F.B	Inverse active region

48. What does the "breaking capacity" of a fuse indicate?
   (a) The maximum current the fuse can safely carry continuously

(b) The time it takes for the fuse to blow in the event of a fault

(c) The time it takes for the fuse to blow in the event of a fault

(d) The ability of the fuse to interrupt a fault current without being damaged

Ans. (d) : "Breaking Capacity" of a fuse indicate the ability of the fuse to interrupt fault current without being damaged.

■ Breaking capacity = $\sqrt{3}VI$ MVA

■ Rating of circuit breaker is MVA.

49. In a basic contactor circuit, what is the role of the coil?
(a) It opens and closes the contacts
(b) It regulates the current flow
(c) It controls the voltage
(d) It generates heat

Ans. (a) : In a basic contactor circuit, the role of the coil is that it opens and close the contacts.

**50. Which part of a relay is responsible for physically opening and closing the electrical contacts?**
(a) Housing   (b) Armature
(c) Coil   (d) Core

Ans. (b) : Armature is the part of a relay that is responsible for physically opening and closing the electrical contacts.

51. What is the binary equivalent of the decimal number 25?
(a) 10011   (b) 10101
(c) 11101   (d) 11001

Ans. (d) : Binary equivalent of the decimal number 25
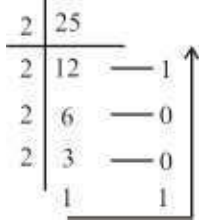
$(25)_{10} = (11001)_2$

52. Which type of battery charger is best suited for charging lead-acid batteries used in automobiles?
(a) Pulse charger
(b) Trickle charger
(c) Fast charger
(d) Constant voltage charger

Ans. (d) : Constant voltage charger type of battery charger is best suited for charging lead - acid batteries used in automobiles.

53. In the context of digital electronics, what is the base of the octal number system?
(a) 10   (b) 16
(c) 8   (d) 2

Ans. (c) : In the context of digital electronics, 8 is the base of the octal number system.
■ Hexadecimal base = 16
■ Decimal base = 10
■ Binary base = 2

54. What safety precaution should be taken when using a battery charger?
(a) Charge the battery in a well-ventilated area
(b) Use a charger with a higher voltage than recommended for the battery
(c) Touch the battery terminals with bare hands while charging
(d) Keep the charger plugged in continuously even when the battery is fully charged

Ans. (a) : Charge the battery in a well ventilated area type safety precaution should be taken when using a battery charger.

Safety precaution of battery charger -
■ Always read and understand the manufacture instruction before use.
■ The charging area of battery should be properly clean and well ventilated.
■ Ensure the charger is disconnected from the power source before connecting or disconnecting it to the battery.

55. What happens to the conductivity of an intrinsic semiconductor with an increases in temperature?
(a) Conductivity increases
(b) Conductivity becomes zero
(c) Conductivity decreases
(d) Conductivity remains constant

Ans. (a) : In an intrinsic semiconductor as temperature increased, the conductivity typically increased, this is primarily due to the increased generation of charge carriers through thermal excitation.
■ The conductivity of an intrinsic semiconductor depend upon the number of hole electron pair and mobility. The number of hole electron pairs increases with an increase in temperature, while its mobility decreases. However, the increase in hole electron pair is greater than the decrease in their mobility.

A Semiconductor has a negative temperature coefficient
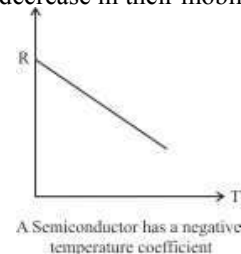
56. Which type of motor starter is best suited for applications where a gradual increase in speed is required to avoid mechanical shocks?
(a) Auto Transformer Starter
(b) Soft Starter
(c) Magnetic Motor Starter
(d) Star-Delta Starter

Ans. (b) : Soft starter is best suited for application where a gradual increase in speed is required to avoid mechanical shocks.

Application of soft starter-
(i) In pumps
(ii) In conveyor belts
(iii) For fan and blowers
(iv) For compressor
■ Soft starter can be used for any motor that requires a controlled and smooth start and stop.

57. What is back electromotive force (Back EMF) in the context of electric motors?
  (a) The force driving the motion of a motor
  (b) The voltage drop across the motor's power supply
  (c) The voltage generated in the opposite direction to the applied voltage
  (d) The force resisting the motion of a motor

Ans. (c) : The voltage generated (Back emf) in the opposite direction to the applied voltage in the context of electric motors.
In dc motor,

Back emf $(E_b) = \dfrac{N\phi PZ}{60A}$

Where,
  N = Speed (in r.p.m)
  ϕ = Flux (Weber)
  P = Poles
  Z = Number of conductor
  A = Number of parallel path

58. In a balanced three-phase AC system, what is the relationship between line current (I_L) and phase current (I_p)?
  (a) $I_L = \sqrt{3}I_p$ (b) $I_L = 3I_p$
  (c) $I_L = 2I_p$ (d) $I_L = I_p$

Ans. (d) : In a balanced three - phase AC system, the relationship between the line current (I_L) and phase current (I_p) are equal.
■ In star connection-
$V_L = \sqrt{3}V_{ph}$
$I_L = I_{ph}$
■ In delta connection-
$I_L = \sqrt{3}I_{ph}$
$V_L = V_{ph}$

59. What is the purpose of a distribution transformer in an electrical system?
  (a) To step up voltage for transmission
  (b) To generate electrical power
  (c) To step down voltage for distribution
  (d) To control current flow in feeder lines

Ans. (c) : The purpose of a distribution transformer in an electrical system is to step down voltage for distribution.
■ **Distribution transformers-** The distribution transformer is a step down transformer.
■ These are used to step down the voltage used in the distribution lines.
■ The distribution transformers have the rating of up to 200kVA.

60. Which type of filter is commonly used in conjunction with a rectifier circuit to reduce voltage ripples in the output?
  (a) Bandstop filter   (b) Bandpass filter
  (c) High-pass filter   (d) Low-pass filter

Ans. (d) : Low - pass filter is commonly used in conjunction with a rectifier circuit to reduce voltage ripples in the output.
■ **Low-pass filter-** A low-pass filter is a type of signal processing filter that allows low- frequency signals to pass through while attenuating high-frequency signals.

Application of low-pass filter-
 (i) Remove noise and high frequency interference
(ii) Smooth out signals.
(iii) Rejects high - frequency components
(iv) Allow low - frequency components to pass through.

61. What is the primary purpose of conducting a No-Load test on an induction motor?
  (a) To determine the maximum power the motor can deliver
  (b) To measure the stator and rotor resistances
  (c) To evaluate the core losses and no-load current
  (d) To assess the efficiency of the motor under loaded conditions

Ans. (c) : The primary purpose of conducting a no-load test on an induction motor is to evaluate the core losses and no-load current.
■ The no-load test provides valuable information about the motor performance, including -
(i) Efficiency at no load
(ii) Magnetizing current
(iii) No - load current and power consumption
(iv) Motor constants (eg magnetizing reactance, core loss resistance)
■ This test is an important part of motor testing and commissioning, helping to ensure the motor is operating within design specifications and efficiently.

62. What is the primary function of the stator in an induction motor?
  (a) To provide mechanical support
  (b) To regulate the speed of the motor
  (c) To convert electrical energy into mechanical energy
  (d) To generate a rotating magnetic field

Ans. (d) : The primary function of the stator in an induction motor is to generate a rotating magnetic field.
■ **The primary function of the stator in an induction motor is to-**
(i) Produce a rotating magnetic field.
(ii) Provide a stationary reference frame for the rotor to rotate within.
(iii) House the windings (coils) that carry the AC supply.
(iv) Generate a torque - producing flux that interacts with the rotor conductors.

63. What is the advantage of using a bridge rectifier over a half - waver rectifier?
  (a) Simplicity of design   (b) Equivalent size
  (c) Higher efficiency   (d) Lower cost

Ans. (c) : The advantage of using a bridge rectifier over a half-wave rectifier is higher efficiency.
■ **The advantage of using a bridge over a half - wave rectifier-**
(i) Higher efficiency
(ii) Smoother output
(iii) Higher output frequency
(iv) Better voltage regulation
(v) Higher transformer utilization factor
(vi) Lower ripple factor
(vii) Higher average output voltage

64. What is the primary insulating material used in the construction of high - voltage transmission cables for electrical power distribution?
(a) XLPE   (b) PVC
(c) Polyethylene   (d) Glass

Ans. (a) : XLPE (Cross - linked polyethylene) is the primary insulating material used in the construction of high - voltage transmission cables for electrical power distribution.
■ XLPE is a material used in electrical systems, specifically for insulation in electrical cables and wires.

65. When connecting single-phase transformers in parallel, what is a critical consideration to ensure proper operation?
(a) Transformers should be connected with reversed polarity
(b) Transformers should have different primary and secondary voltages
(c) Transformers should have the same voltage ratio
(d) Transformers must have different kVA ratings

Ans. (c) : Transformers should have the same voltage ratio when connecting single - phase transformers in parallel, is a critical consideration to ensure proper operation.
■ **For parallel operation of transformer, the following condition must be same-**
(i) Same voltage ratio
(ii) Same voltage rating
(iii) Same frequency rating
(iv) Same phase sequence
(v) Similar impedance
(vi) Same polarity

66. In a 4 to 1 multiplexer, how many control inputs (select lines) are needed to select one of the four input channels?
(a) 3   (b) 1
(c) 4   (d) 2

Ans. (d) : In a 4 to 1 multiplexer, two control inputs (Select lines) are needed to select one of the four input channels.
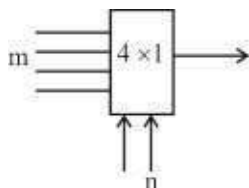
$m \le 2^n$
Where,
m = No. of input line
n = No. of selection line
$2^n = 4 = 2^2$
n = 2 (Selection line)

67. Which component in a hydroelectric power plant is responsible for converting the kinetic energy of flowing water into mechanical energy?
(a) Transformer   (b) Dam
(c) Generator   (d) Turbine

Ans. (d) : Turbine in hydroelectric power plant is responsible for converting the kinetic energy of flowing water into mechanical energy.
■ **The main types of turbines used in hydro electric power plants are following-**
(1) Reaction turbines -
■ Generate power from the combined forces of pressure and moving water.
■ Used for sites with lower head and higher flows
■ Subtypes - propeller (including kaplan), francis and kinetic
(2) Impulse turbines -
■ Uses the velocity of water to move the runner
■ Discharges at atmospheric pressure
■ Suitable for high - head, low-flow applications
■ Subtypes- Pelton and cross - flow
(3) Kaplan turbines-
■ A type of propeller turbine
■ Has adjustable blades and wickets gates
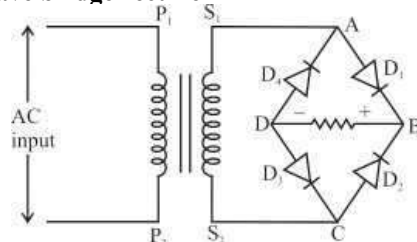■ Allows for a wider range of operation
■ Suitable for low - head sites with a large flow rate.

68. In a bridge rectifier circuit, how many diodes are used to convert AC (Alternating Current) to DC (Direct Current)?
(a) 4   (b) 2
(c) 6   (d) 1

Ans. (a) : In a bridge rectifier circuit, four diodes are used to convert AC (Alternating current) to DC (Direct current).
Full wave bridge rectifier-

| Parameter	Half wave rectifier	Full wave center tapped rectifier	Full wave bridge rectifier
Average value	$\dfrac{V_m}{\pi}, \dfrac{I_m}{\pi}$	$\dfrac{2V_m}{\pi}, \dfrac{2I_m}{\pi}$	$\dfrac{2V_m}{\pi}, \dfrac{2I_m}{\pi}$
Form factor	1.57	1.11	1.11
Peak factor or crest factor	2	1.414	1.414
PIV	V_m	$2V_m$	V_m
Diode	1	2	4
Ripple factor	1.21 →1φ 0.17 →3φ	0.48 →1φ 0.05 →3φ	0.48

69. If you measure the voltage across a resistor in an AC circuit and find it to be 10V at a certain moment, what does this value represent?
(a) The average voltage across the resistor
(b) The root mean square (RMS) voltage across the resistor
(c) The peak voltage across the resistor
(d) The instantaneous voltage across the resistor

Ans. (d) : Measure the voltage across a resistor in an AC circuit and find it to be 10V at a certain moment, this value represent the instantaneous voltage across the resistor.

Instantaneous values - Instantaneous value of an alternating quantity such as current or voltage over one complete cycle.

■ It is denoted by always small letters.

$$V = V_m \sin\omega t$$
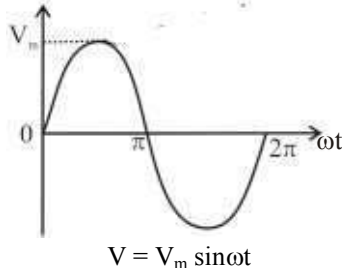
70. What is the purpose of insulators in a 230V distribution system?
   (a) To increase voltage
   (b) To prevent electrical shock
   (c) To decrease current
   (d) To enhance energy efficiency

Ans. (b) : The purpose of insulators in a 230V distribution system to prevent the electrical shock.

Purpose of insulators - Insulator are used in electrical equipment to support and separate electrical conductors without allowing current through themselves.

71. What role does the commutator play in conjunction with the armature in a DC generator?
   (a) It reverses the direction of current in the armature coil
   (b) It provides mechanical support to the armature
   (c) It generates the magnetic field within the generator
   (d) It regulates the speed of the generator

Ans. (a) : The commutator play in conjunction with the armature in a DC generator, the commutator reverse the direction of current in the armature coil.

■ **Function of commutator -** In the DC generator, the commutator is used to convert generated AC in armature into DC.

■ In DC motor, the commutator is used to convert DC to AC.

■ A commutator consists of a set of copper segments which are insulated from each other.

■ Physical connection of commutator to the armature winding is made through a commutator brush arrangement.

72. What is the primary purpose of a transmission network in a power system?
   (a) To distribute electrical power to end-users
   (b) To generate electrical power
   (c) To store electrical power
   (d) To transmit electrical power over long distance

Ans. (d) : The primary purpose of a transmission network in a power system is to transmit electrical power over long distances.

■ The main function of transmission network is to transfer power from power generating station to distribution sub-station.

■ The main function of distribution networks is to transfer power which is transferred from transmission networks to consumer.

73. What does Dissolved Gas Analysis (DGA) primarily assess in a transformer?
   (a) Oil quality
   (b) Winding resistance
   (c) Power loss
   (d) Insulation resistance

Ans. (a) : Oil quality is Dissolved Gas Analysis (DGA) primarily assess in a transformer.

■ **Dissolved Gas Analysis (DGA) of transformer -** Dissolved Gas Analysis (DGA) of transformers can provide insights into thermal and electrical stresses sustained by oil- immersed power transformers, because it detects incipient transformer faults, DGA can help prevent further damage.

74. What happens to the output voltage of a DC generator if the field current is increased?
   (a) The output voltage increases
   (b) The output voltage decreases
   (c) The generator stops working
   (d) The output voltage remains unchanged

Ans. (a) : The output voltage of a DC generator is increases, if the field current is increased.

If $I_f \uparrow$ then $\phi\uparrow$
$E_g \uparrow \propto \phi \uparrow$
$\uparrow V = \uparrow E_g - I_a R_a$
Where,
     E_g = Induced e.m.f.
     V = Output voltage of DC generator
     I_a = Armature current
 R_a = Armature resistance
     I_f = Field current.

75. What happens to the width of the depletion region in a PN junction diode under reverse bias?
   (a) It increases   (b) It remains constant
   (c) It becomes zero   (d) It decreases

Ans. (a) : Increases the width of the depletion region in a PN junction diode under reverse bias.

■ When P-N junction is reverse biased, then the depletion region is increased i.e. the potential barrier increased.

■ When P-N junction is forward biased, then the depletion region is decreased i.e. the potential barrier decreased.
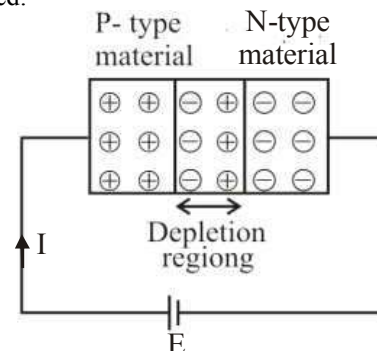
76. **Which type of fire extinguisher is suitable for class B type of fires in context of Indian standard?**
(a) Water type (stored pressure)
(b) Water type (gas cartridge)
(c) Halon type
(d) Greased powder type, IS 11833

Ans. (c) : Halon type of fire extinguisher is suitable for class B type of fires in context of Indian standard.

Classes of Fire	Types of Fire
Class 'A'	Ordinary combustibles such as wood, paper, cloth, rubber and some plastics.
Class 'B'	Flammable liquids such as gasoline, petroleum, greases, tars, oil, oil based paints, solvents, alcohols.
Class 'C'	Fires by propane, butane and LPG gas etc.
Class 'D'	Fire due to electric wire and electric materials.
Class 'E'	Cooking oils and greases such as animal and vegetable fats

77. **What is the purpose of using a Ground Fault Circuit Interrupter (GFCI) in electrical illumination systems?**
(a) To prevent overloading of circuits
(b) To regulate voltage levels
(c) To protect against electric shock
(d) To enhance energy efficiency

Ans. (c) : The purpose of using a ground fault circuit interrupter (GFCI) in electrical illumination systems to protect against electric shock.
■ **Purpose of a ground fault circuit interrupter (GFCI)** - GFCI is a fast acting circuit breaker designed to shut off electric power in the event of a ground - fault within as little as 1/40 of a second.
■ A ground fault circuit interrupter is designed to prevent electrical shock to individuals. A person is shocked when they become part of a complete circuit.

78. **Which semiconductor material is commonly used in the fabrication of photovoltaic cells for solar power generation?**
(a) Copper   (b) Silicon
(c) Zinc   (d) Aluminum

Ans. (b) : Silicon (Si) semiconductor material is commonly used in the fabrication of photovoltaic cells for solar power generation.
Photo diode-

Symbol of photodiode
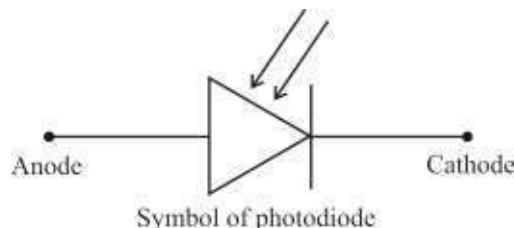
Photodiodes are a class of diodes that converts light energy into electricity. Photodiode can also be used in detecting the brightness of the light.
■ Photodiodes works on the principle of the photoelectric effect.
Applications of photodiode -
■ Photodiodes are used in optical communication system.
■ Photodiodes are used in electronics devices like smoke detectors, televisions and remote controls.
■ It is used in solar cell panels.

79. **What is the primary function of an EX-OR (exclusive OR) gate in digital logic circuits?**
(a) It produces a high output when all inputs are high
(b) It performs subtraction of binary numbers
(c) It produces a high output when the number of both inputs is odd
(d) It performs addition of binary numbers

Ans. (c) : The primary function of a an EX-OR (exclusive OR) gate in digital logic circuits is that it produces a high output when the number of both inputs is odd.
EX-OR (exclusive OR) gate-

$$Y = A\bar{B} + \bar{A}B = A \oplus B$$
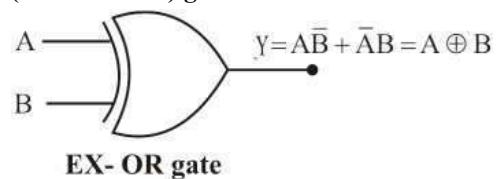
EX- OR gate

Truth table-

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

■ The EX-OR (XOR) gate outputs true only when its two binary inputs are unequal.
■ The EX-OR gate outputs false only when its two binary inputs are equal.

80. **What is the primary function of an inverter in an electrical system?**
(a) DC to AC conversion
(b) Power distribution
(c) Voltage regulation
(d) Current amplification

Ans. (a) : DC to AC conversion is primary function of an inverter in an electrical system.
■ An inverter converts the DC electricity from sources such as batteries or fuel cells to AC electricity.

ISRO (SDSC) Sriharikota Exam, 2023
Technician-B (Electrician)
Solved Paper

Date: 14.02.2024   **Timing: 4:00 PM-5:30 PM**

1.   What is the size in sq. mm of RABBIT conductor in ACSR Category?
(a) 100 sq. mm   (b) 80 sq. mm
(c) 50 sq. mm   (d) 148 sq. mm

Ans. (c) : The size of RABBIT conductor in ACSR category is 50 sq. mm

ACSR code No.	Type of ACSR	Nominal Aluminium area (mm²)
1.	Squirrel	20
2.	Rabbit	50
3.	Dog	100
4.	Panther	391

2.   If voltmeter is wrongly connected in series with a load, the_____will result?
(a) The meter will burn out
(b) The meter reads normally voltage drop
(c) The meter will read the current drawn
(d) The load will not draw its current, and no reading in the meter

Ans. (d) : If voltmeter is wrongly connected in series with a load, then the load will not draw its current and no reading in the meter.
■ Resistance of voltmeter is high (infinite in the ideal case). If connected in series with the load, then overall resistance of the circuit will become very high, due to this high resistance, the current flowing in the circuit will tend to zero i.e. become very low.

3.   The main purpose of LED driver in a light fitting is to provide _____?
(a) Initially high AC voltage
(b) Low voltage AC
(c) Constant DC current
(d) Protection against short circuit

Ans. (c) : The main purpose of LED driver in a light fitting is to provide constant DC current or DC voltage.
■ The LED drivers provide protection to the LED bulbs against current and voltage fluctuations.
■ The drivers ensure that the voltage and current to the LED bulbs remains within the operating range of the LED regardless of fluctuations in the mains supply.

4.   What does OFAF cooling index for transformer mean?
(a) Oil Forced Air Forced
(b) On Fan Always Fan
(c) SF 6 and Fan Cooled
(d) Oil Forced Natural Air cooled

Ans. (a) : OFAF cooling index for transformer mean oil forced air forced.
OFAF = Oil Forced Air Forced

5.   The expansion of AAAC conductor is
(a) Additional Aluminium Alloy conductor
(b) Aluminium Alloy copper Conductor
(c) Aluminium Conductor Steel reinforced
(d) All Aluminium Alloy Conductor

Ans. (d) : The expansion of AAAC conductor is All Aluminium Alloy conductor.
■ AAAC (All Aluminium Alloy conductor)-
AAAC conductor is made from aluminium magnesium and silicon alloy of high electrical conductivity. Containing mg (0.6 - 0.9%) and Si (0.5% - 0.9%) to give it better mechanical properties after treatment.
■ AAAC are extensively used for primary and secondary transmission in bare overhead distribution and transmission lines (11 kV to 765 kV lines) and high substations.

6.   The curve representing Ohm's law is
(a) a parabola   (b) a hyperbola
(c) linear   (d) sine function

Ans. (c) : The curve representing ohm's law is linear.
Ohm's law- ohm's law states that the voltage across a conductor is directly proportional to the current flowing through it, it provided all physical condition and temperature remain constant.
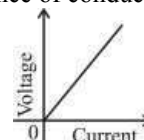Then,

$$V \propto I$$
$$\boxed{V = IR}$$
V = Voltage across conductor
 I = Current
R = Resistance of conductor

7.   Auto transformer is used as
(a) Control transformer
(b) Instrument transformer
(c) Isolation transformer
(d) Variable transformer

Ans. (d) : Auto transformer is used as variable transformer.
Auto transformer- A transformer in which a part of the winding is common in primary and secondary is called an auto transformer.
■ In auto transformer, primary and secondary winding are connected both magnetically and electrically.
■ Conductively transferred (VA) = K_{auto} × Total VA
■ Inductively transferred (VA) = $(1-K_{auto})$ × Total VA

$$K_{auto} = \frac{\text{Lower voltage}}{\text{Higher voltage}}$$

8. Load Factor is the ratio of _____ and_____.
   (a) Maximum Load, Connected Load
   (b) Maximum Load, Average Load
   (c) Average Load, Maximum Load
   (d) Connected Load, Maximum Load

Ans. (c) : Load factor is the ratio of average load and maximum load.
■ Load factor is always less than 1.

$$\boxed{\text{Load factor (L.F)} < 1}$$

Demand factor- It is the ratio of maximum demand to total connected load.

$$\text{Demand factor (DF)} = \frac{\text{Maximum demand}}{\text{Total connected load}}$$

■ It is always less than 1.
Diversity factor- It is the ratio of sum of the individual maximum demands to maximum demand of the system.
■ It is always greater than 1.

9. The Voltmeter range can be extended by
   (a) By connecting High resistance shunt with meter
   (b) By connecting Low resistance shunt with meter
   (c) By connecting High resistance in series with meter
   (d) By connecting low resistance in series with meter

Ans. (c) : The voltmeter range can be extended by connecting high resistance in series with meter.
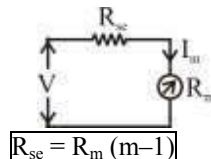
$$\boxed{R_{se} = R_m (m-1)}$$

$$\boxed{m = \frac{V}{V_m}}$$

   R_m = meter resistance
   R_{se} = series resistance
   m = multiplying factor

10. Unit of measurement for magnetic flux is _____?
   (a) Weber   (b) Ampere turn
   (c) Coulomb   (d) None of the above

Ans. (a) : Unit of magnetic flux is weber.

Quantity	Unit
M.M.F	Ampere turn
Charge	Coulomb
Current	Ampere
Magnetic flux density	Weber/m^2
Permeability	Henry/meter

11. Lambert's Cosine law is related to _____ field?
   (a) Electric motor   (b) IIlumination
   (c) Battery   (d) Power factor

Ans. (b) : Lambert's cosine law is related to illumination field.
Lambert's cosine law- Lambert's cosine law states that the radiant intensity from an ideal diffusing reflective surface is directly proportional to the cosine of the angle θ between the direction of incident light and normal to the surface.
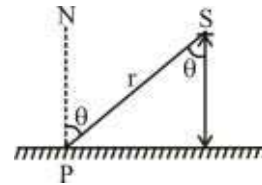
$$\boxed{E = \frac{I\cos\theta}{r^2}}$$

Where,
    E = Illumination (Lumen/m^2 or lux)
    I = Luminous intensity (candela or cd)

12. The amount of heat required to raise the temperature of one kilogram of water through 1°C is described in
   (a) Calorie   (b) Joule
   (c) Kilo Joule   (d) Kilo Calorie

Ans. (d) : The amount of heat required to raise the temperature of one kilogram of water through 1°C is described in kilo calorie.
1 calorie = 4.18 = 4.2 Joule
1 kilocalorie = 4.2×10^3 Joule

13. An incandescent lamp is rated for 110 volts and having a resistance of 20 ohms. Find the resistance required to operate the lamp in 220 V.
   (a) 10 ohms   (b) 2 ohms
   (c) 20 ohms   (d) 200 ohms

Ans. (c) :
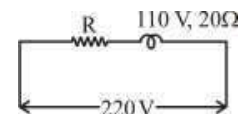
Given that,
        lamp rated resistance = 20
        Rated lamp voltage = 110 V
        Operated lamp voltage = 220 V
        Resistance (R) = ?

$$\because I = \frac{V}{R} = \frac{110}{20} = 5.5 \text{ A}$$

   V = IR
   V = IR$_1$ + IR$_2$
   220 = 5.5 × 20 + 5.5 R$_2$
   220 = 5.5 (20 + R$_2$)

$$\frac{220}{5.5} = 20 + R_2$$

     R$_2$ = 40 − 20
     R$_2$ = 20Ω

14. A kitchen with electric appliances is operating on 230V, 50Hz LT supply for 10 hours. The load comprises of lighting load of 2kW 0.9pf lagging of R- phase, heater load 1kW UPF on Y-phase and a 2kW Grinder 0.8pf lagging, 4kW dish washer 0.95pf and 4kW freezer 0.85 pf. What is the energy consumption by the work shop?
   (a) 130 units   (b) 100.9 units
   (c) 13 units   (d) 65 Units